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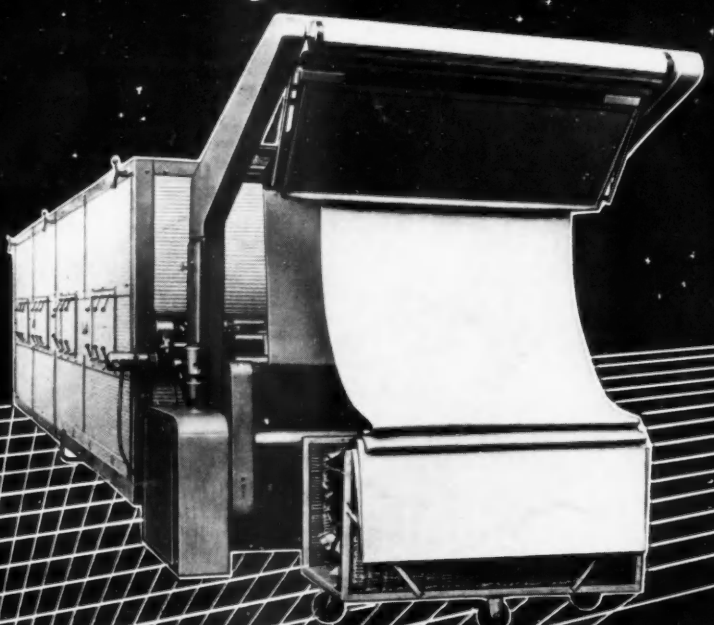

. . . on Stand 2209

1958 TEXTILE RECORDER International TEXTILE MACHINERY AND ACCESSORIES exhibition

BELLE VUE MANCHESTER 15-25 OCTOBER 1958

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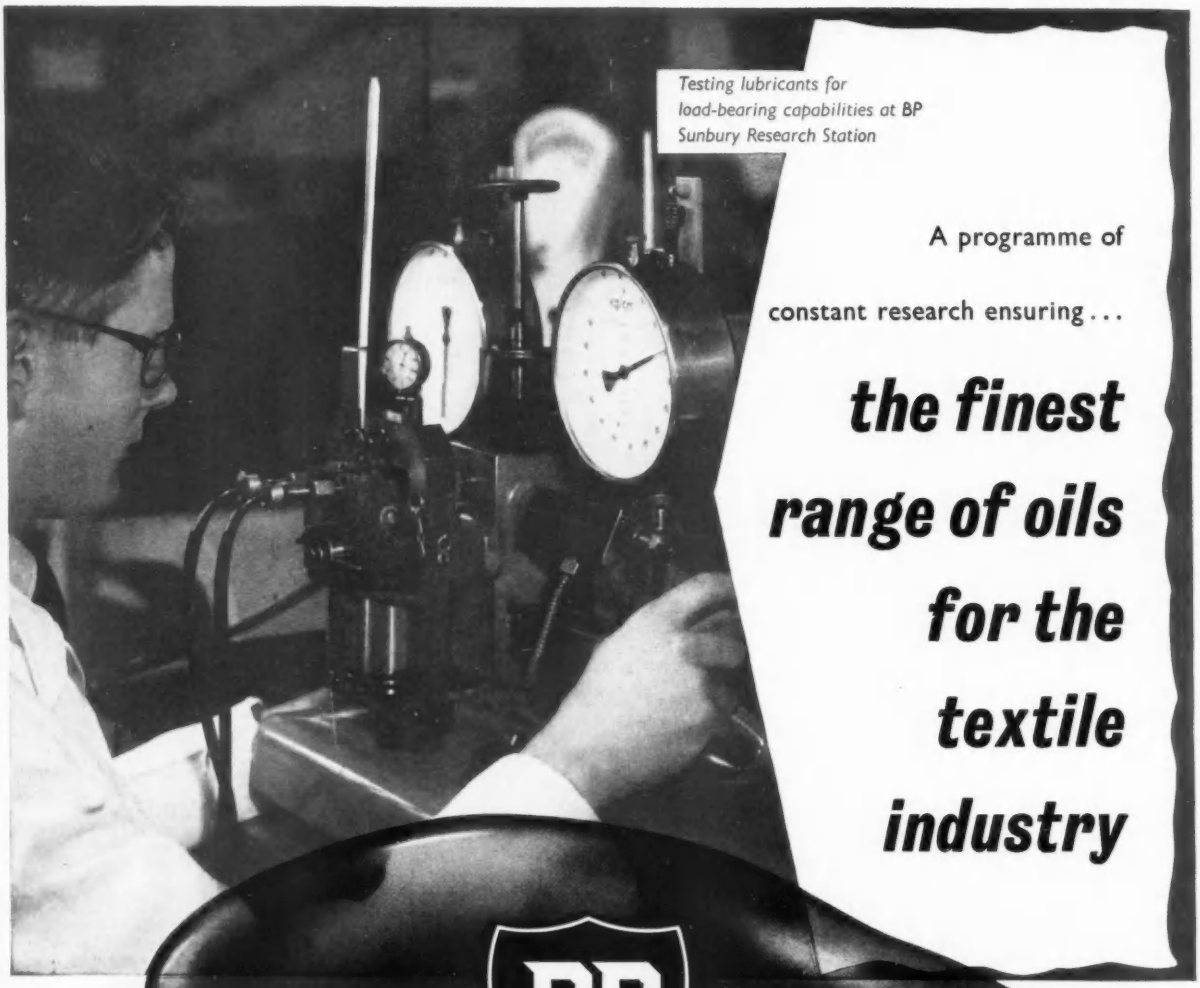

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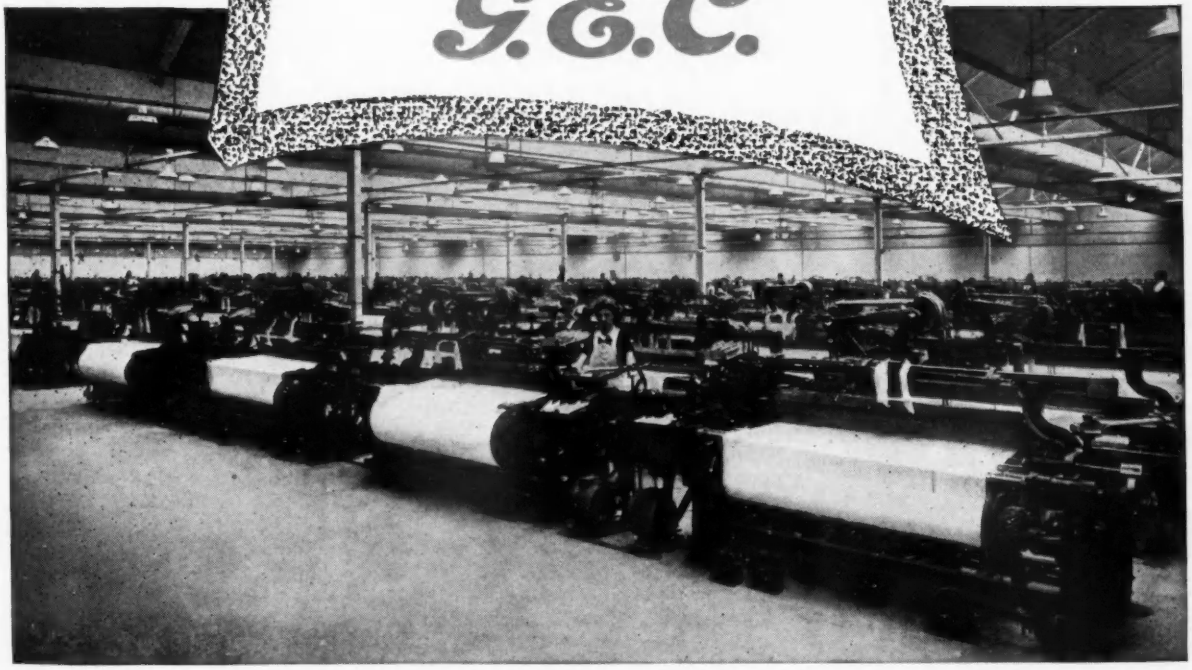

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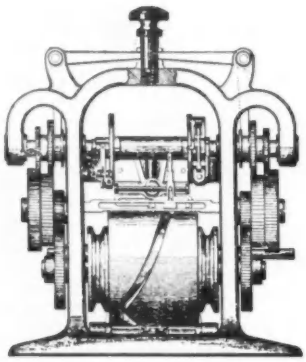

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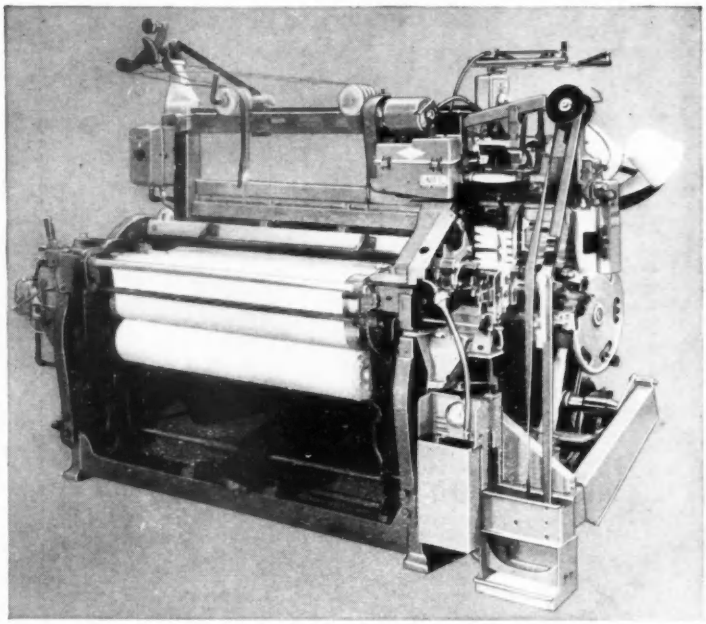

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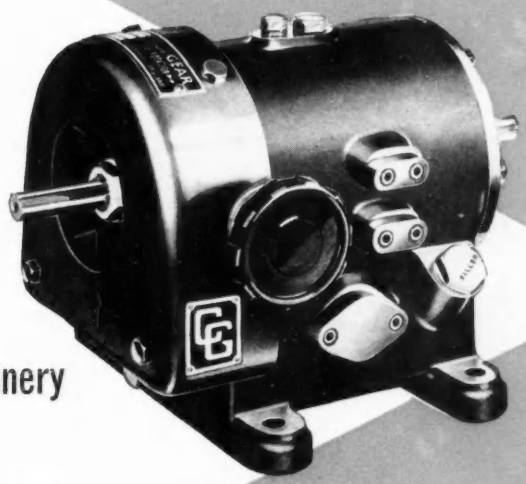

The Textile Machinery
and Accessories
Exhibition
1958

Stand No. 2305 features

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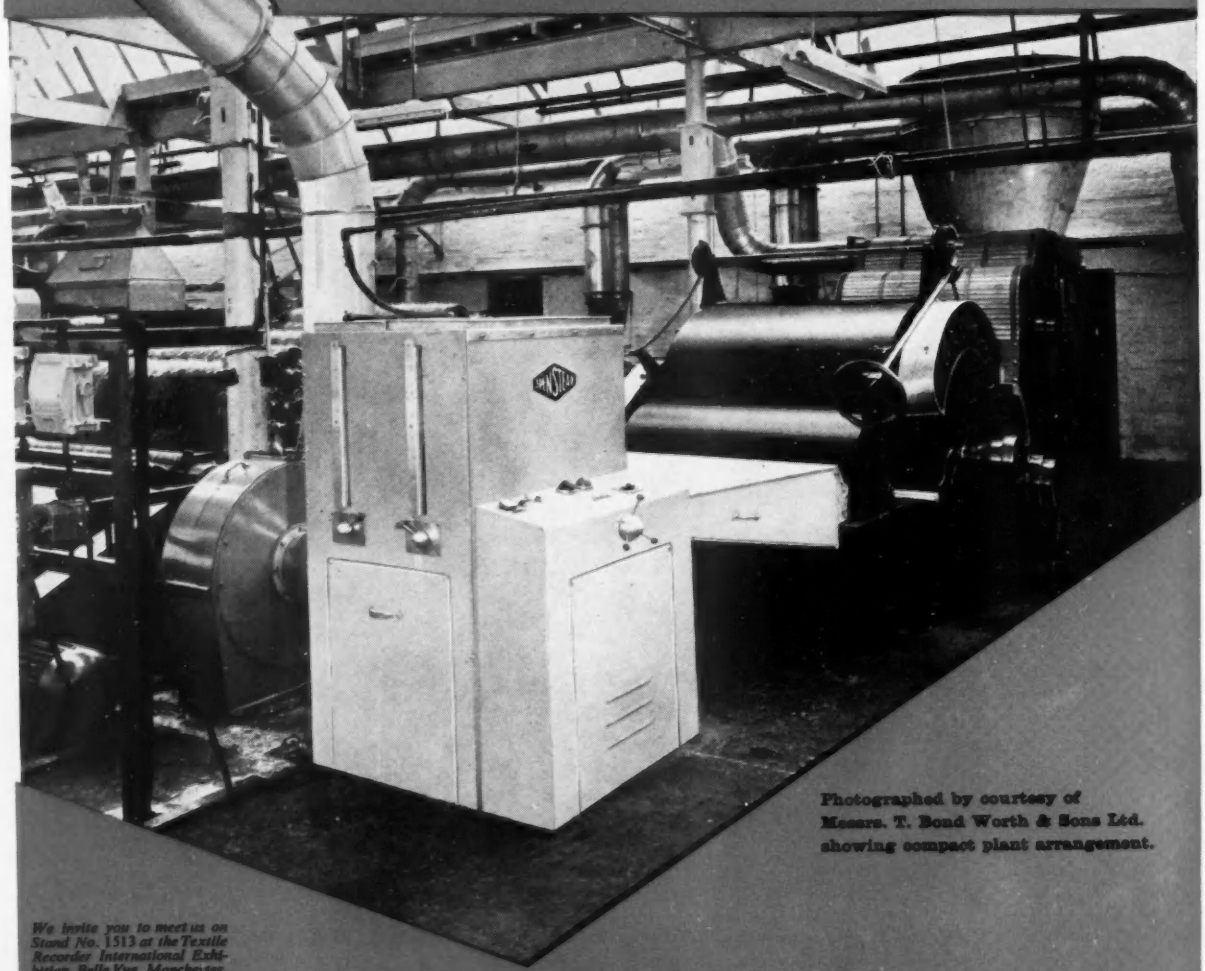
With this new Vortex Wool Oiler you just set the quantity control, "switch on" and the rest is automatic. Wool flow and oil flow are synchronised—No pumps—No compressed air—no jets to make up—no trouble. Only the new Vortex has all you ever hoped for.



Photographed by courtesy of Messrs. T. Bond Worth & Sons Ltd. showing compact plant arrangement.

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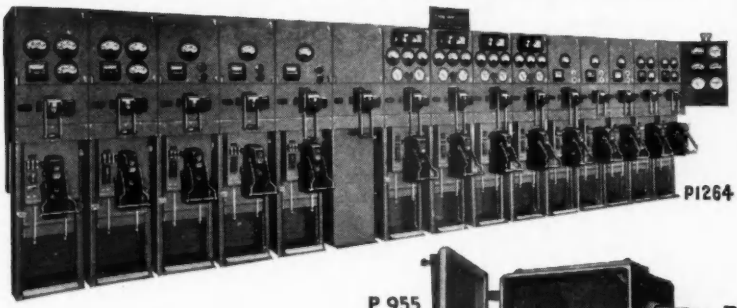
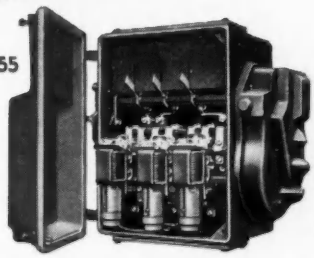
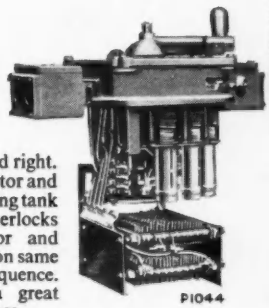


P1264 Illustrated left, Switchboard recently supplied for controlling diesel Alternator Sets and Feeders at a large Sewage Works. This Switchboard is of the duplicate busbar type and contains circuit breakers ASTA tested at 25 MVA to BS. 116 at 400 volts.

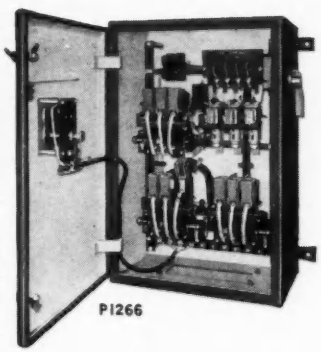


P 955 Illustration on the right is of a hand-operated air break star delta starter, fitted with interlocked isolator and solenoid type overloads with time lags. This starter can also be supplied as a direct-on starter.

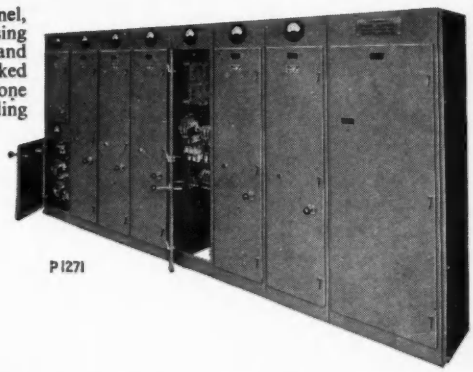


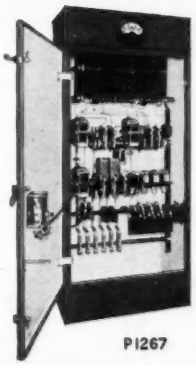
P1044 Illustrated right. Combined type stator and rotor starter showing tank removed. No interlocks required as stator and rotor contacts are on same drum in correct sequence. There is also a great saving in floor space.

CONTACTOR TYPE SWITCHGEAR & MOTOR CONTROL GEAR



P1271 Illustrated right. Multi motor panel, contactor type Switchboard, comprising contactor type stator and rotor starters and star delta starters with fully interlocked isolating switches. This switchboard is one of many supplied to one of the leading Petroleum Companies.





P1266 Starter illustrated above is one of our CS. 30 pattern star delta starters, suitable for use up to 20 H.P. This type of starter is made in different ranges up to 100 H.P.

P1267 Starter illustrated at the left is a 50 H.P. CS. 75 type stator and rotor starter. This starter is made in different ranges up to 100 H.P. All our contactors above the CS. 15 size are bar mounted with powerful magnetic blowouts.

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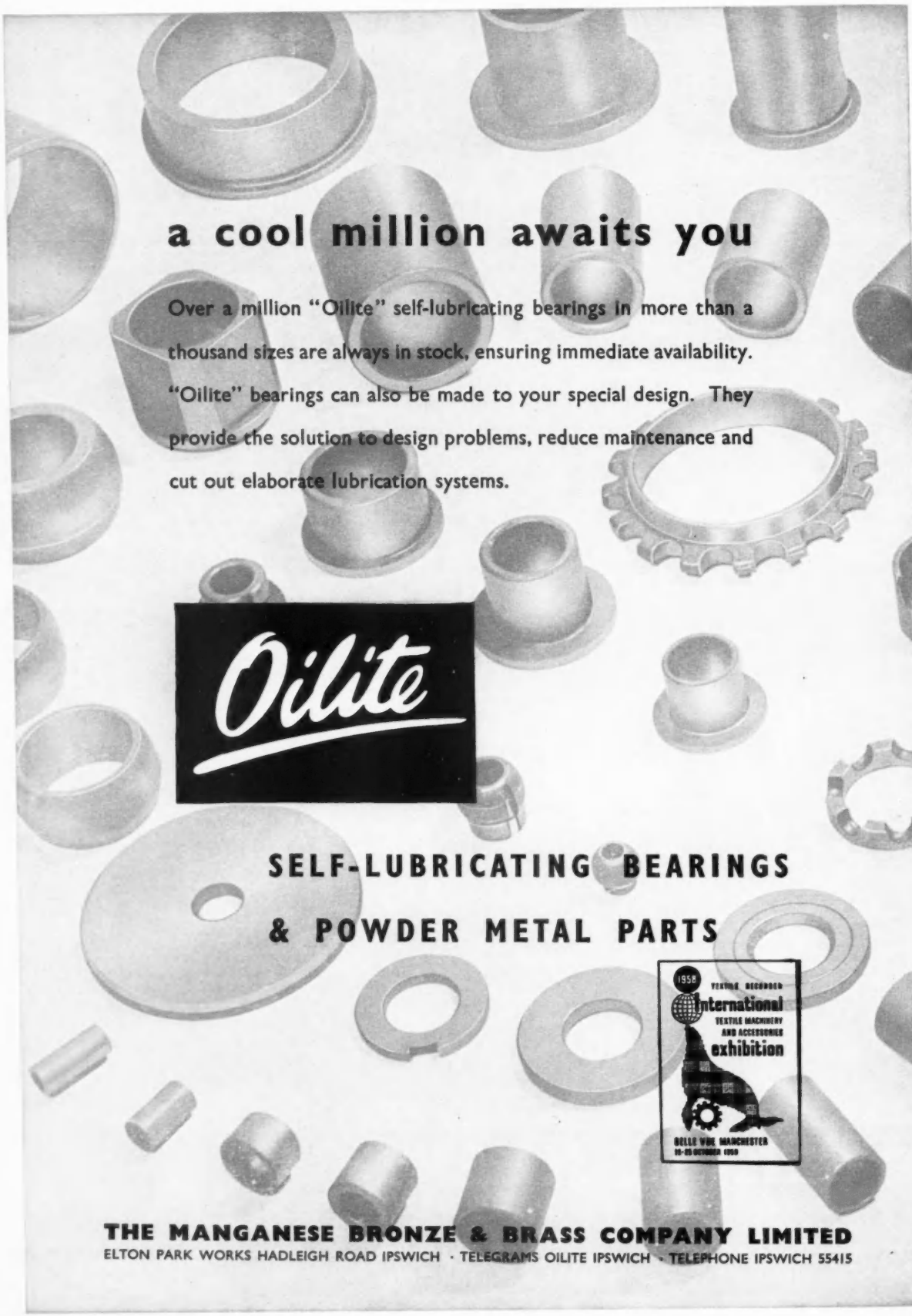

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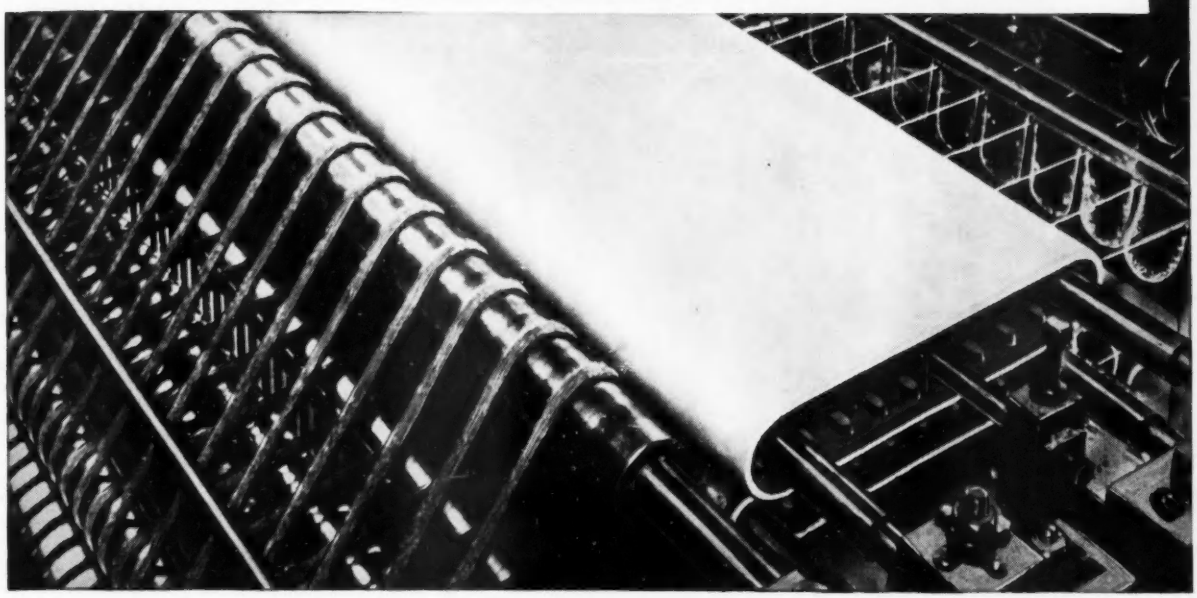

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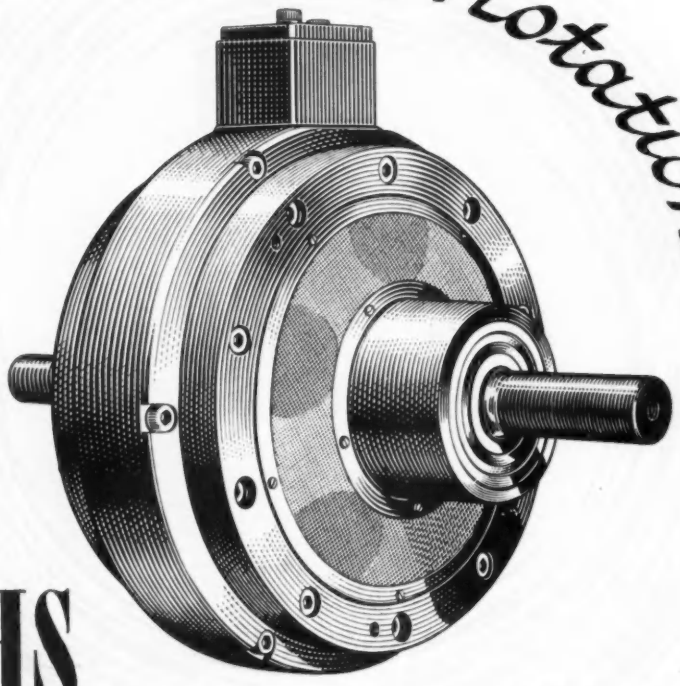

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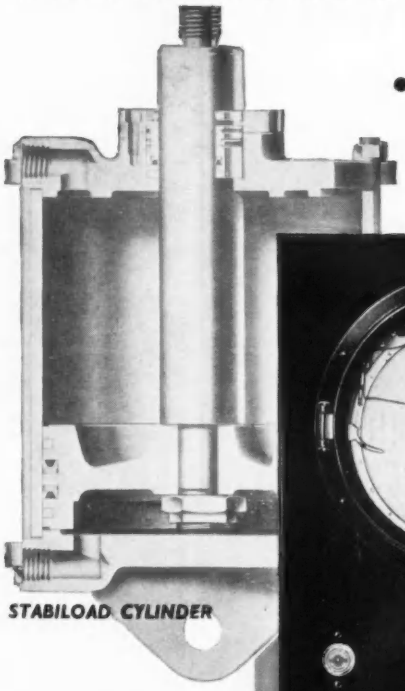

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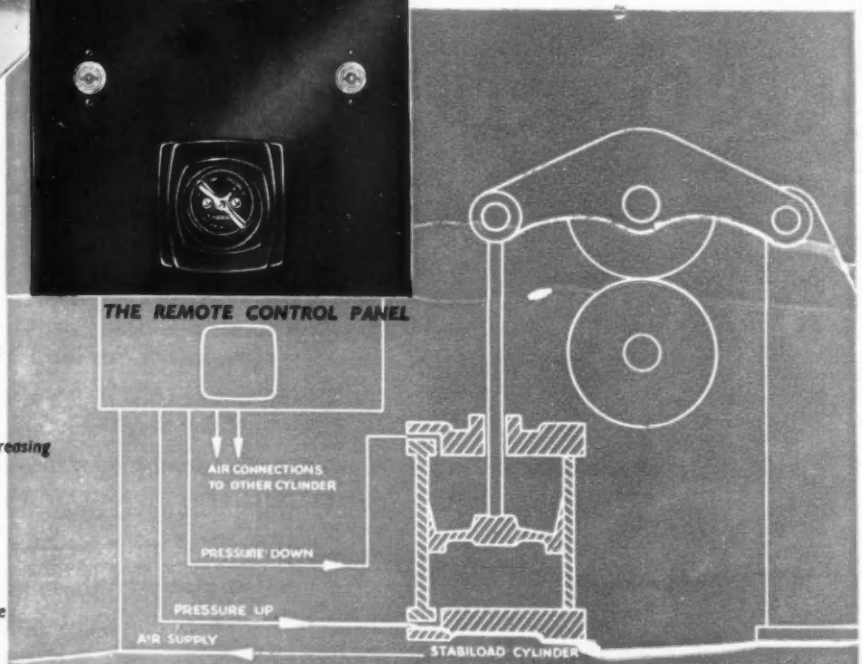

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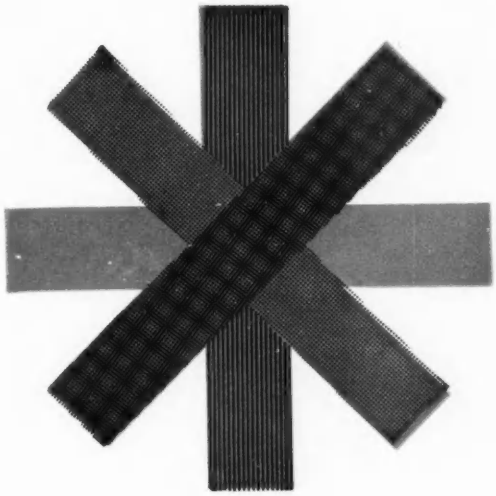

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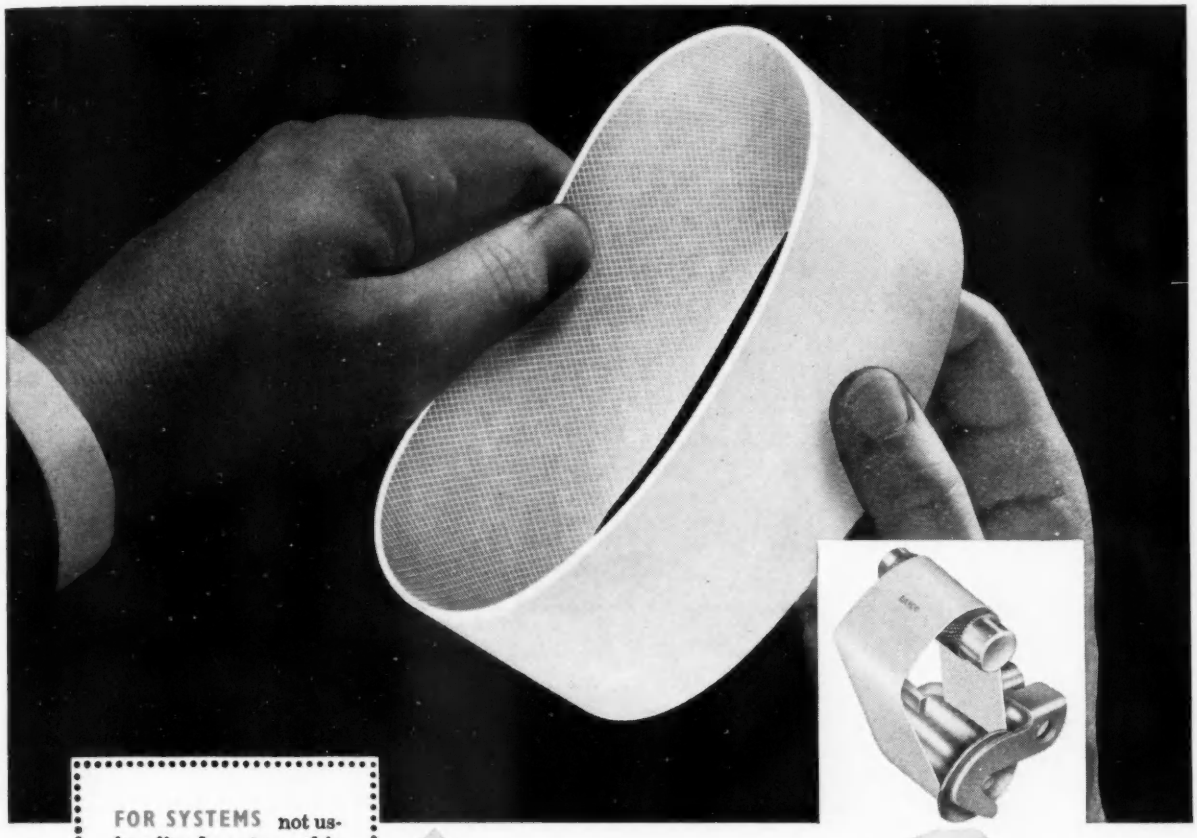

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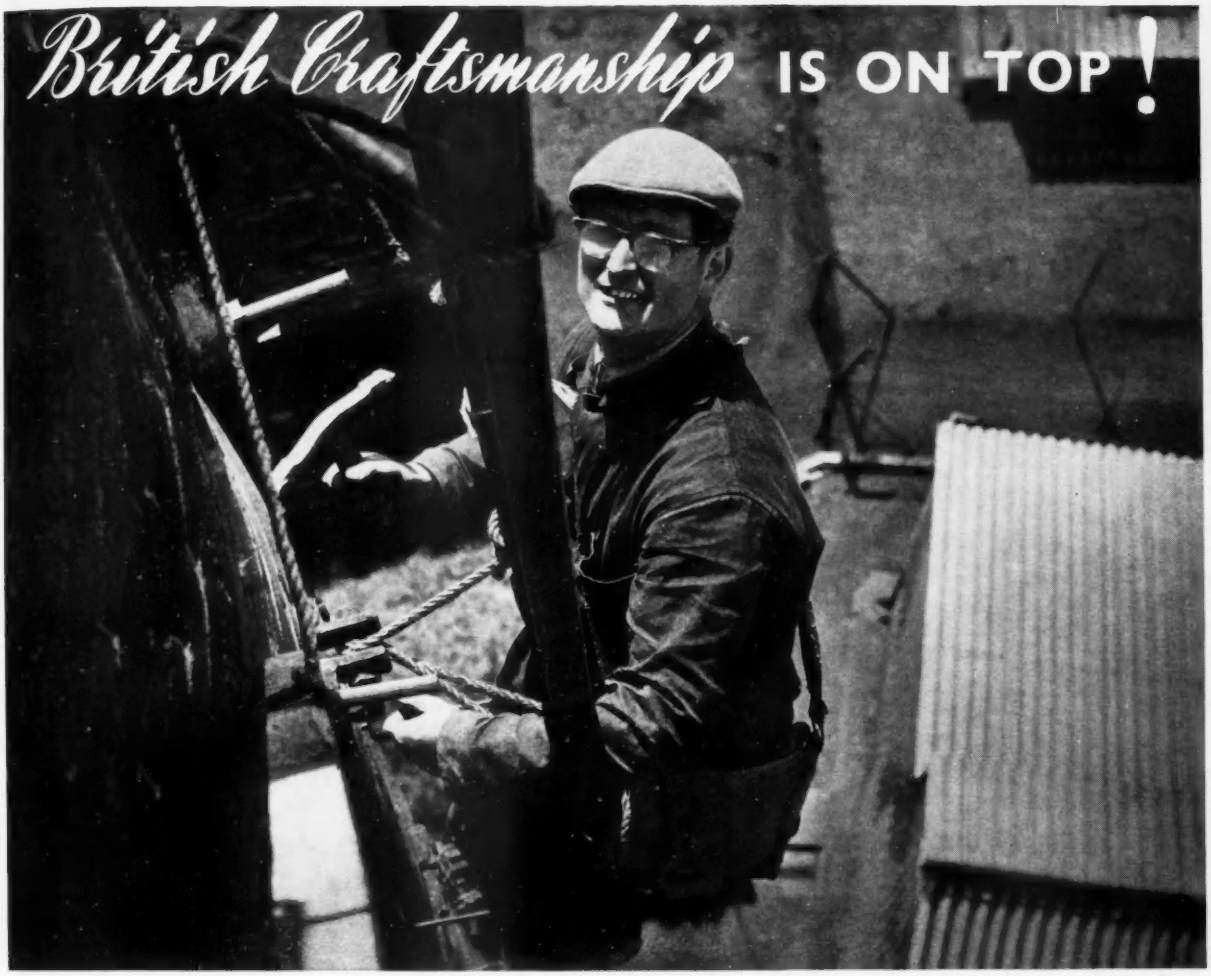

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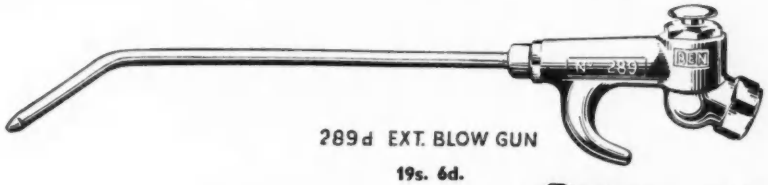

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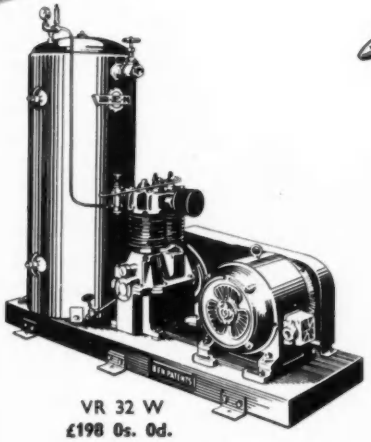

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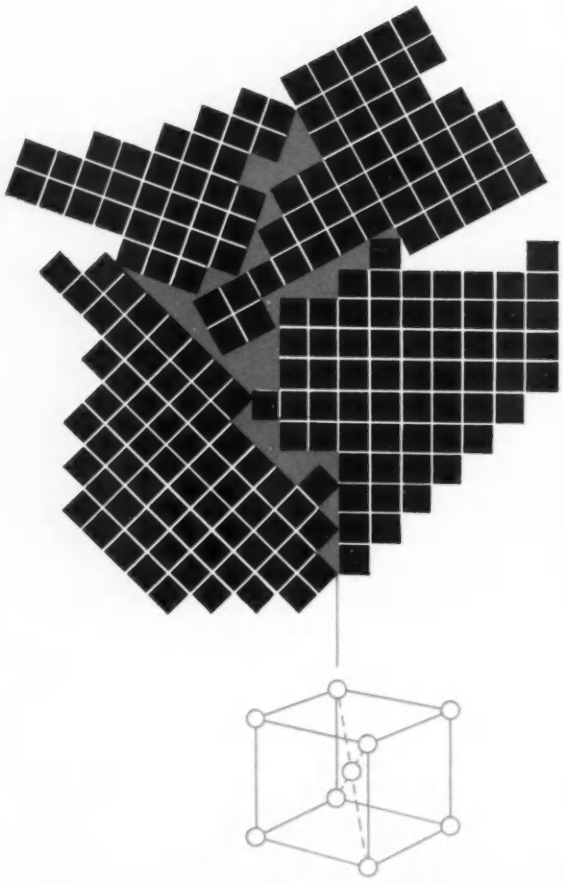

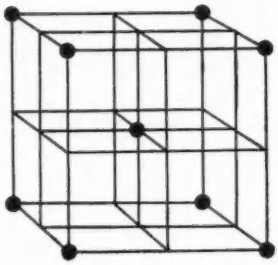

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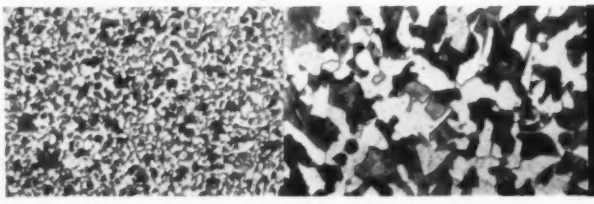

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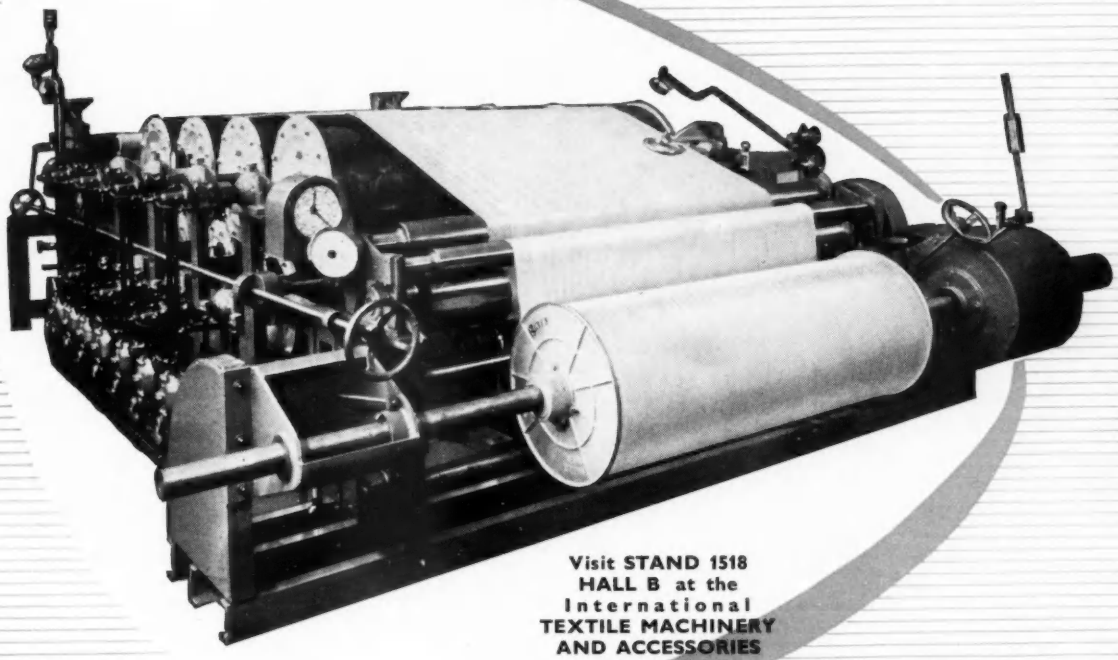

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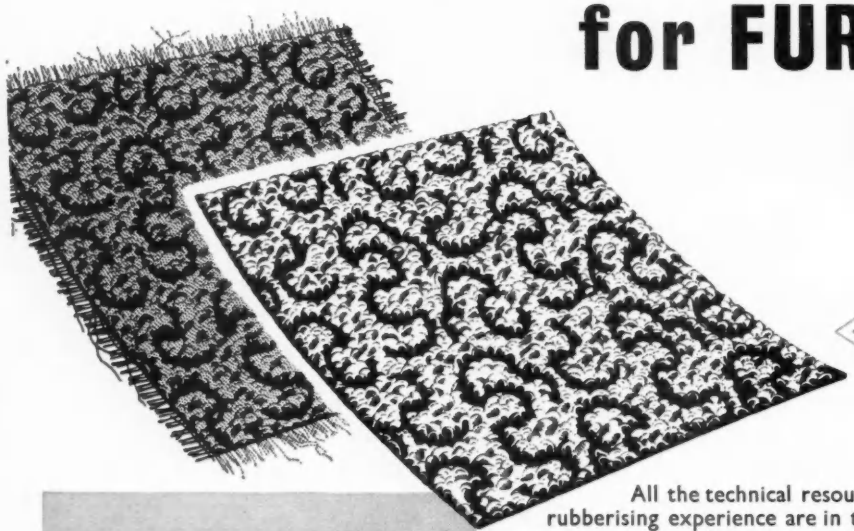

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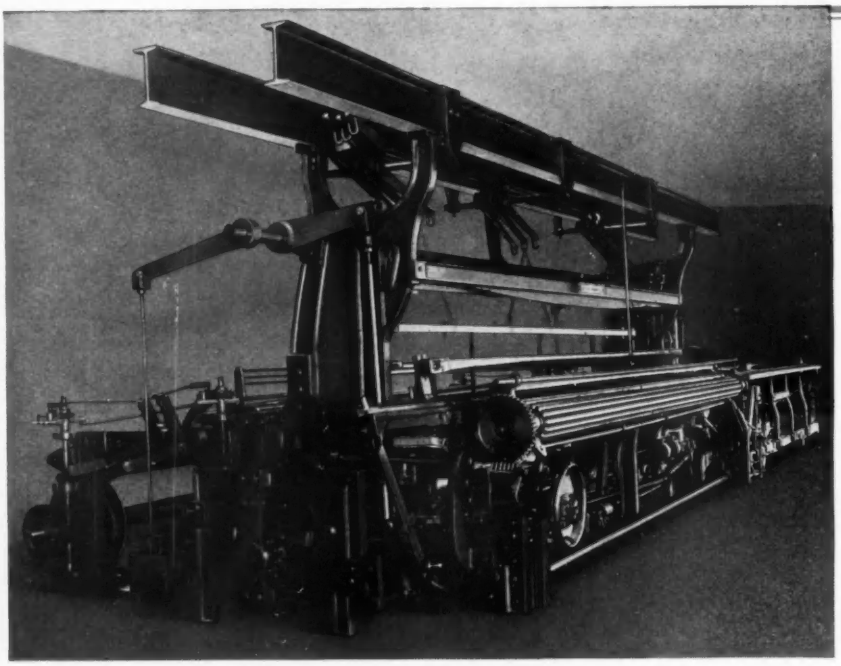

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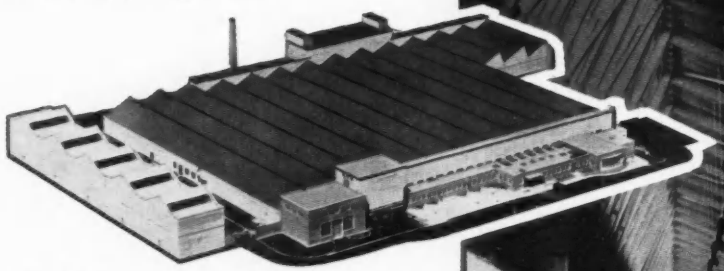

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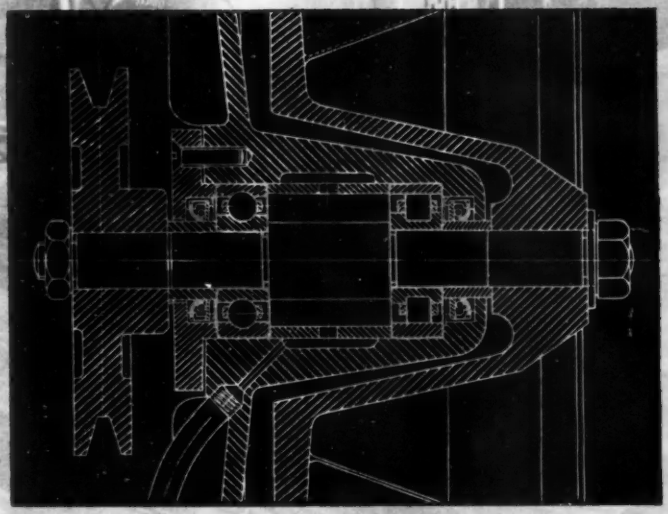

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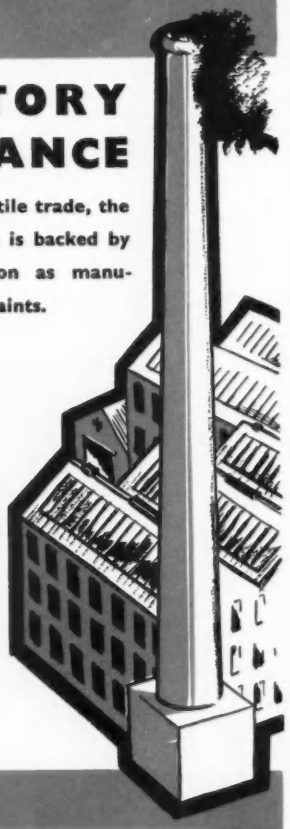

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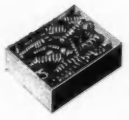

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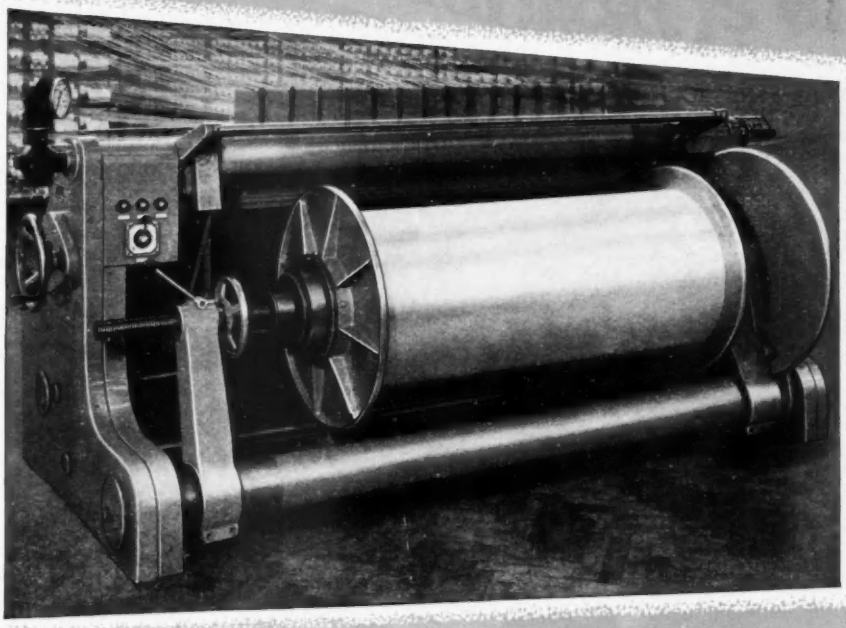

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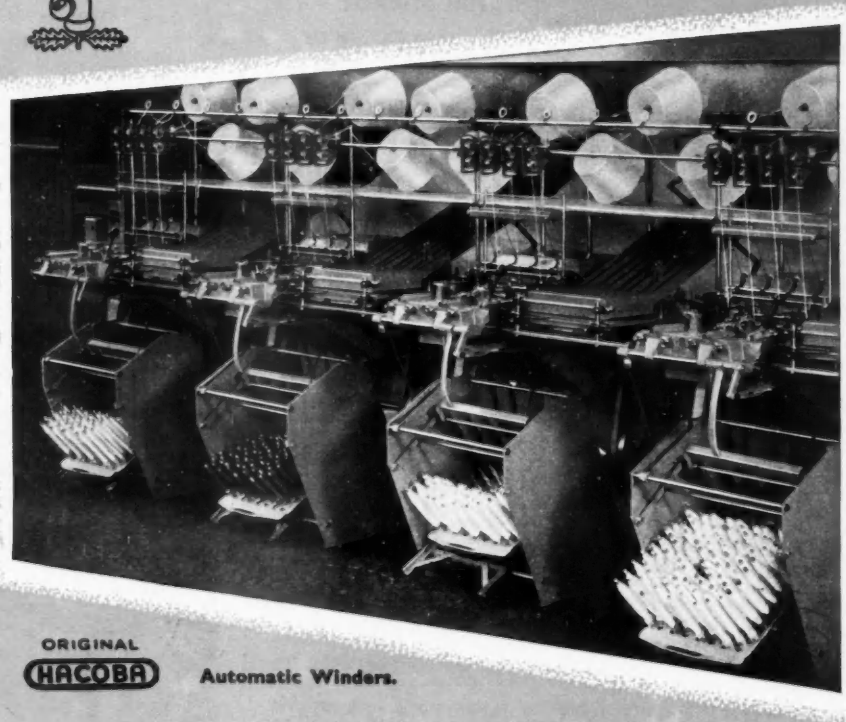

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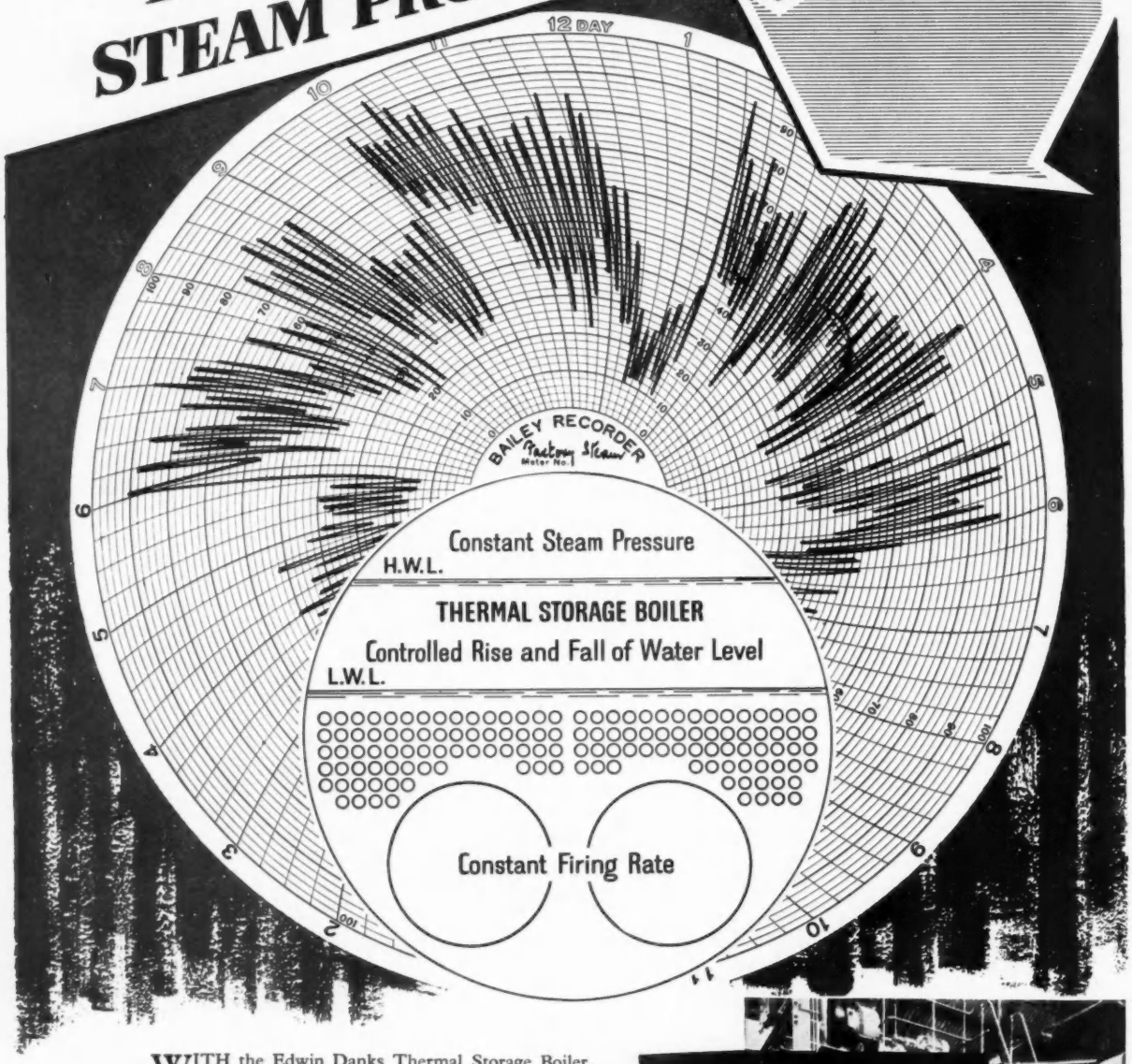

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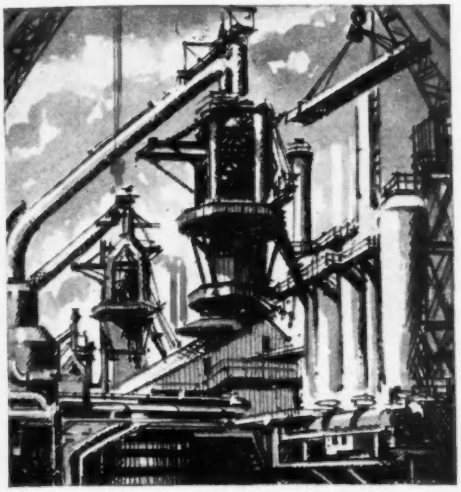

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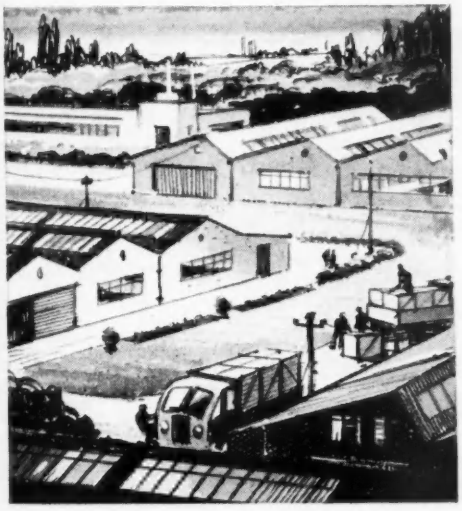

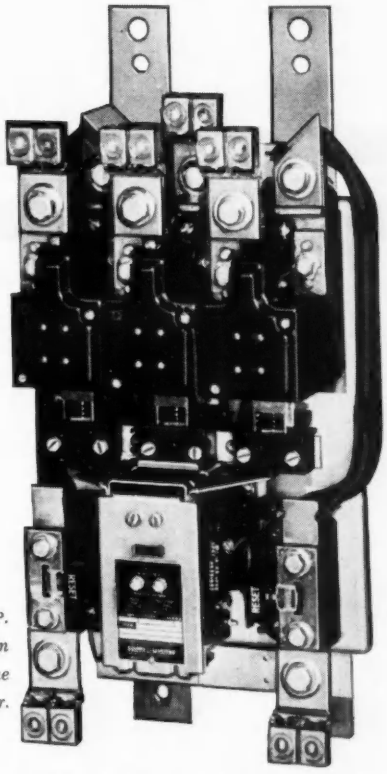

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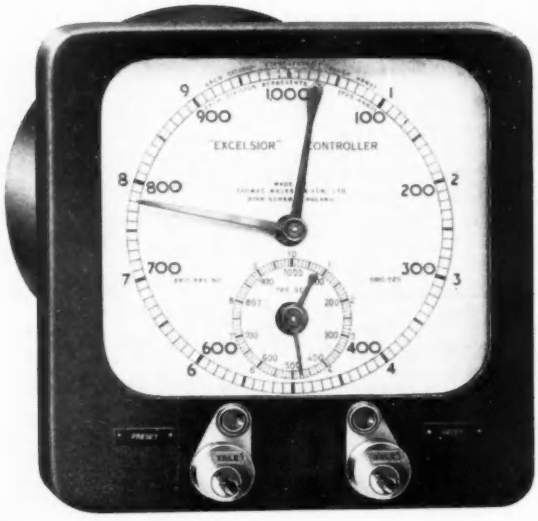

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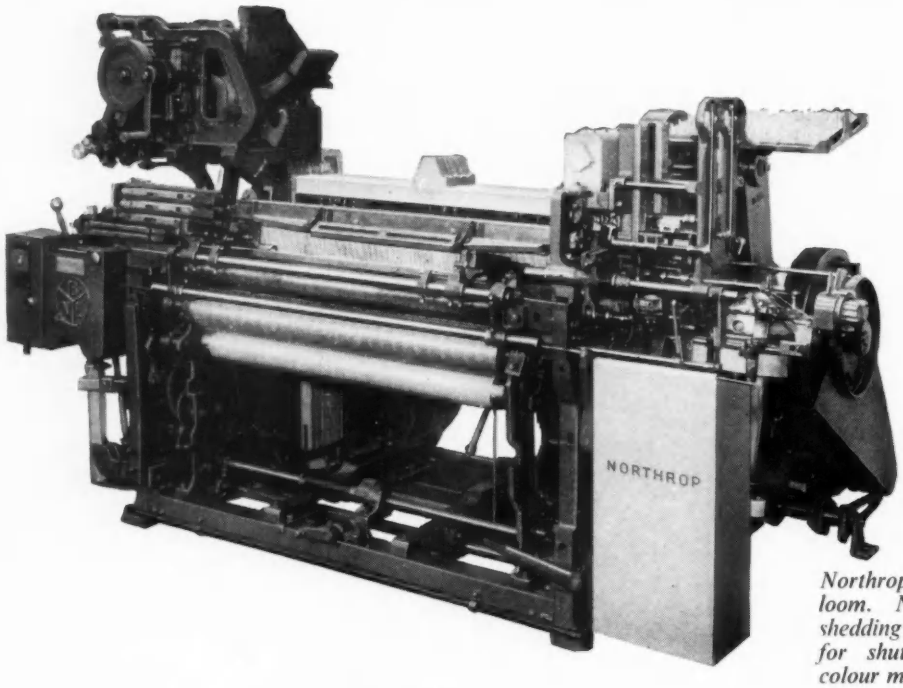

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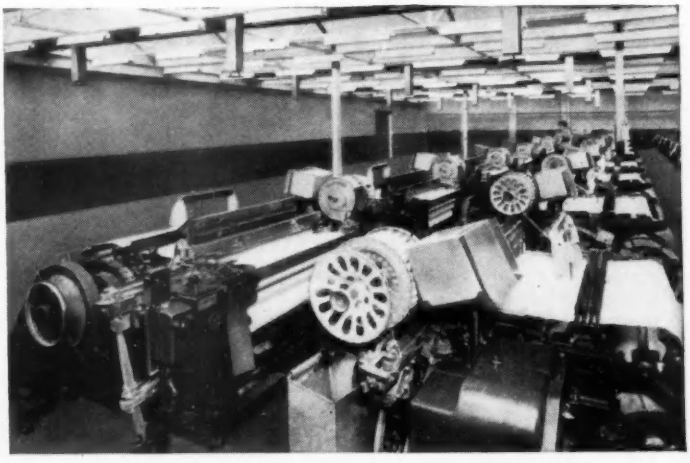

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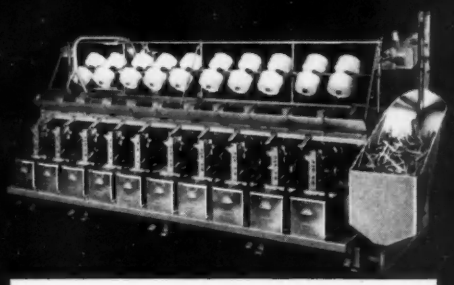

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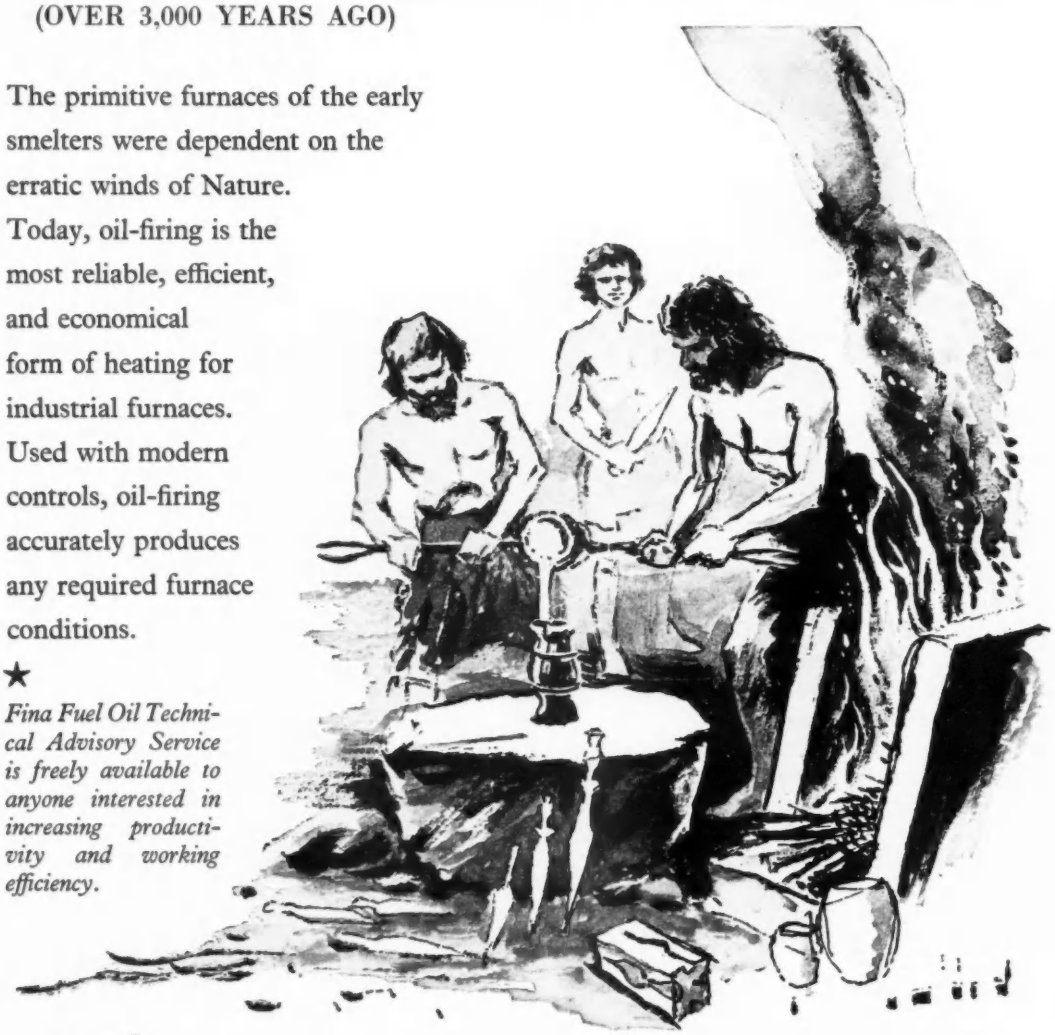

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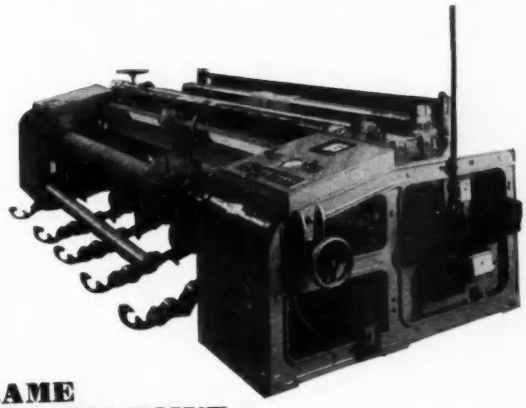

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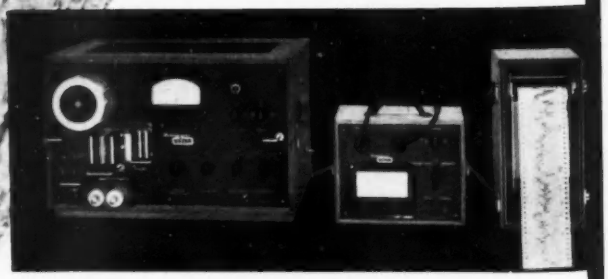

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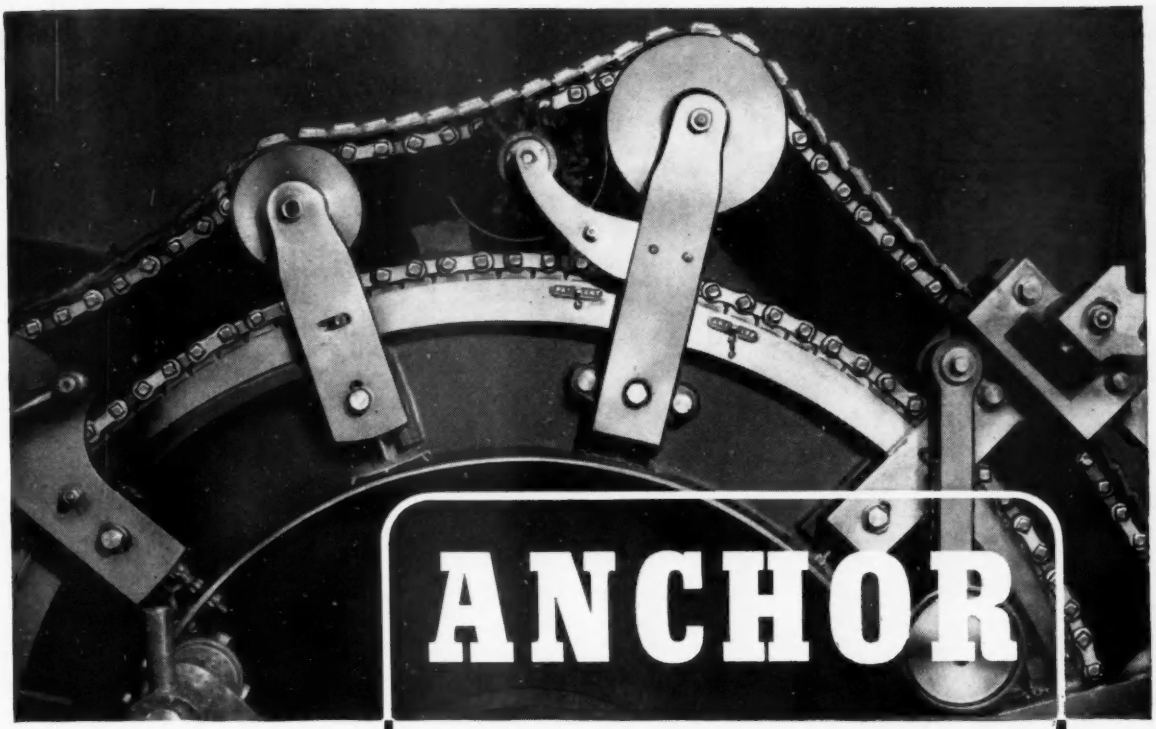

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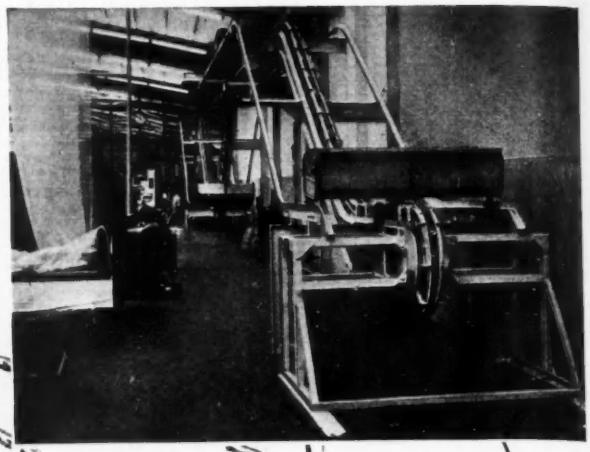

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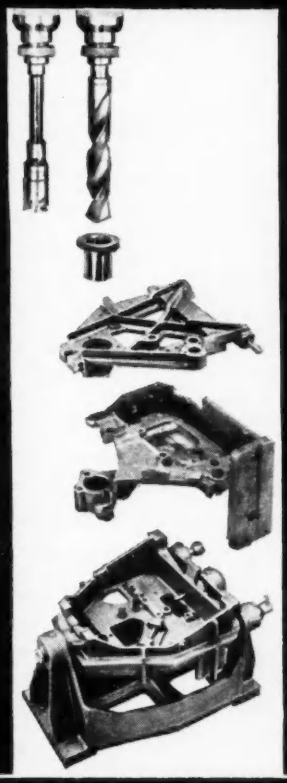

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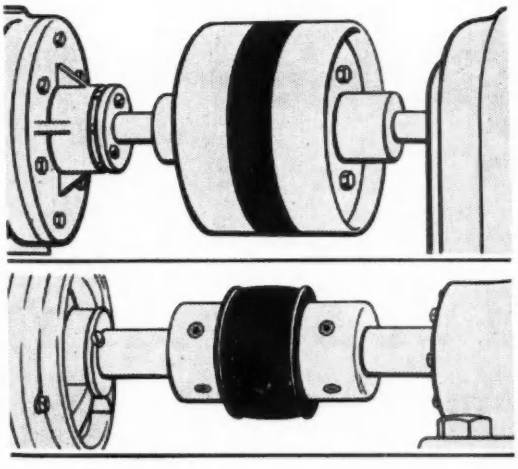

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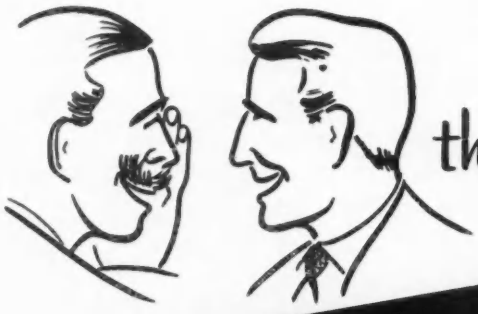

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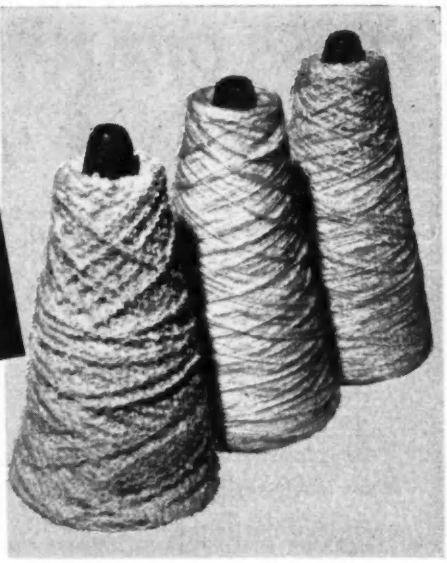

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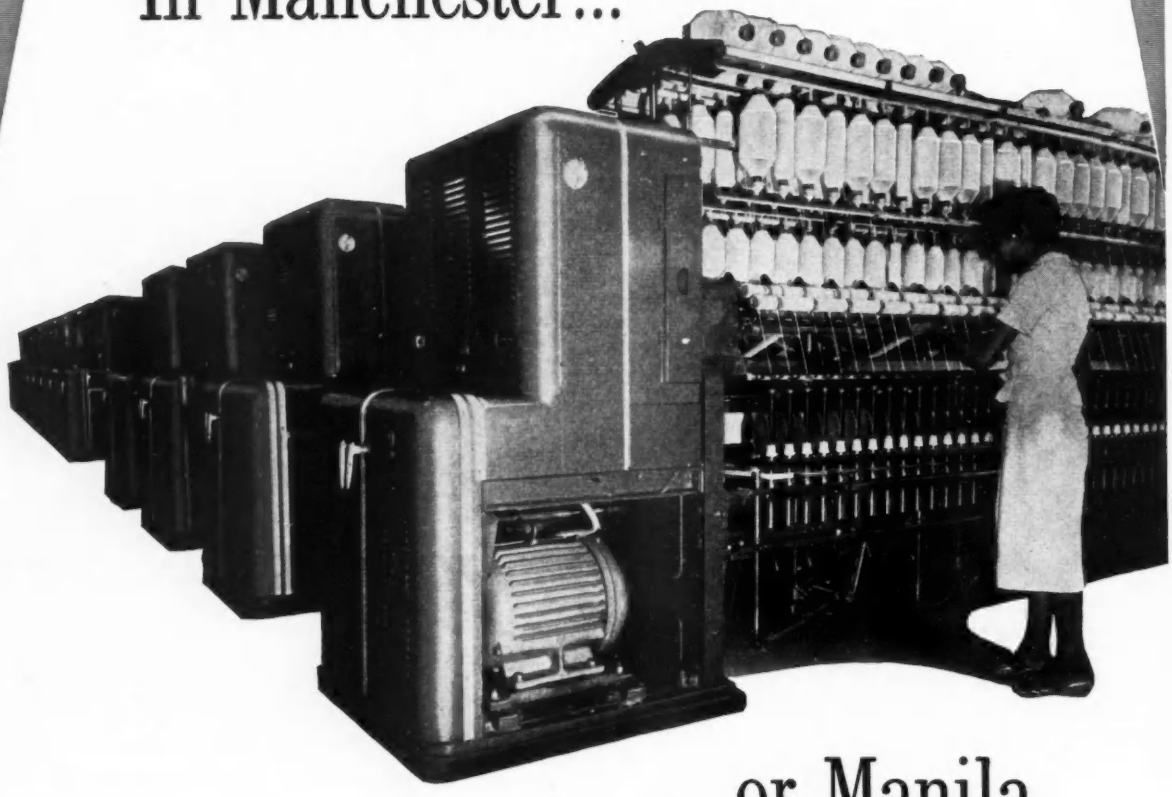

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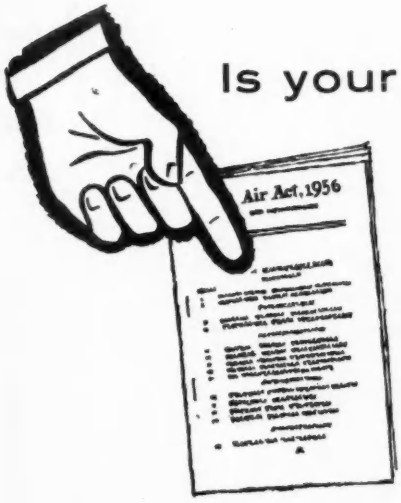

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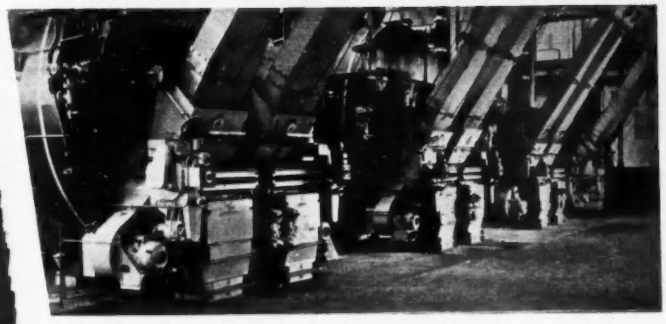

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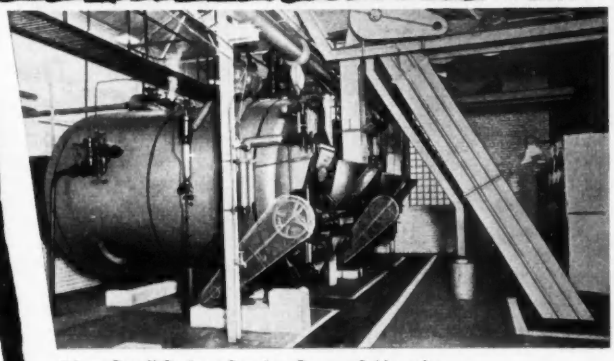

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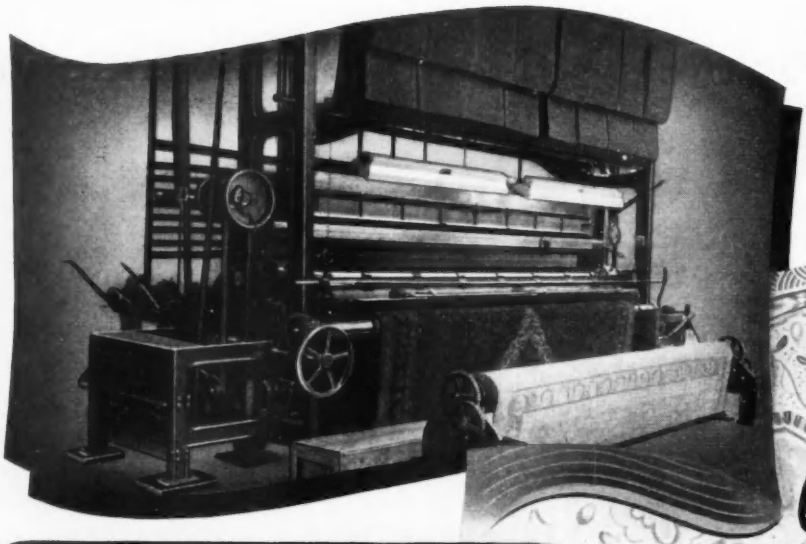

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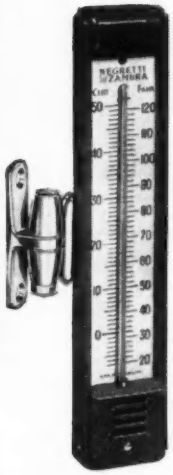

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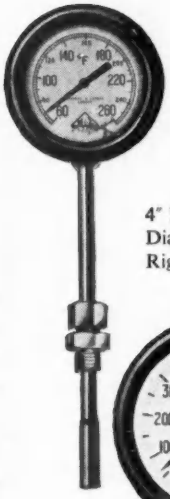

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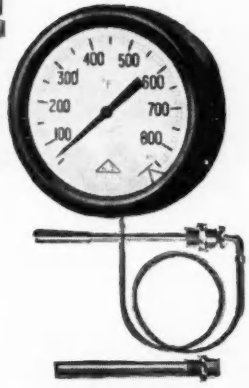

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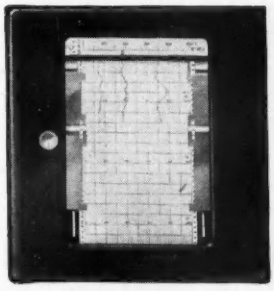

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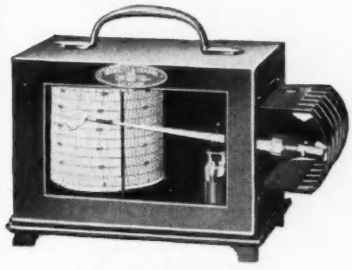

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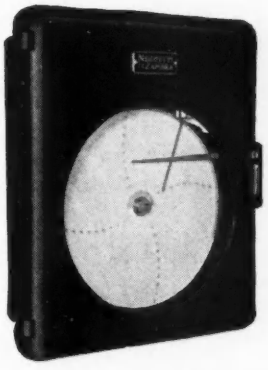

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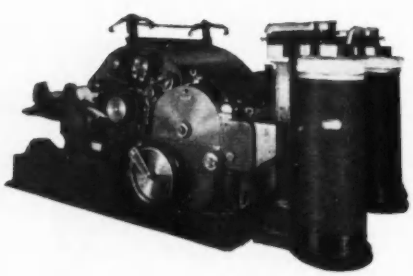

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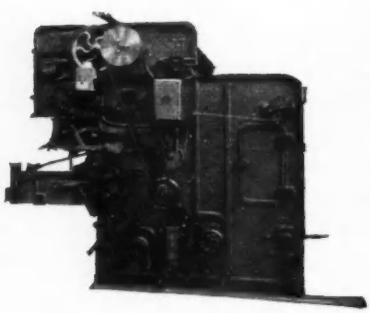

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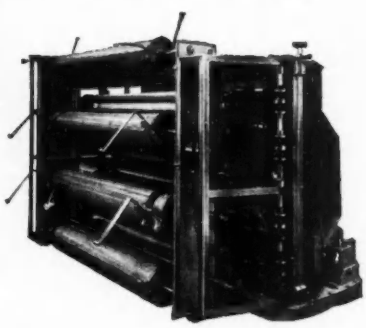

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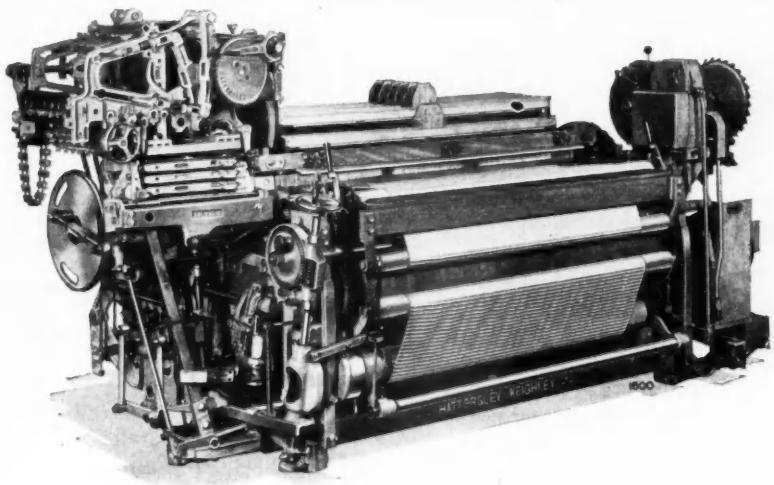

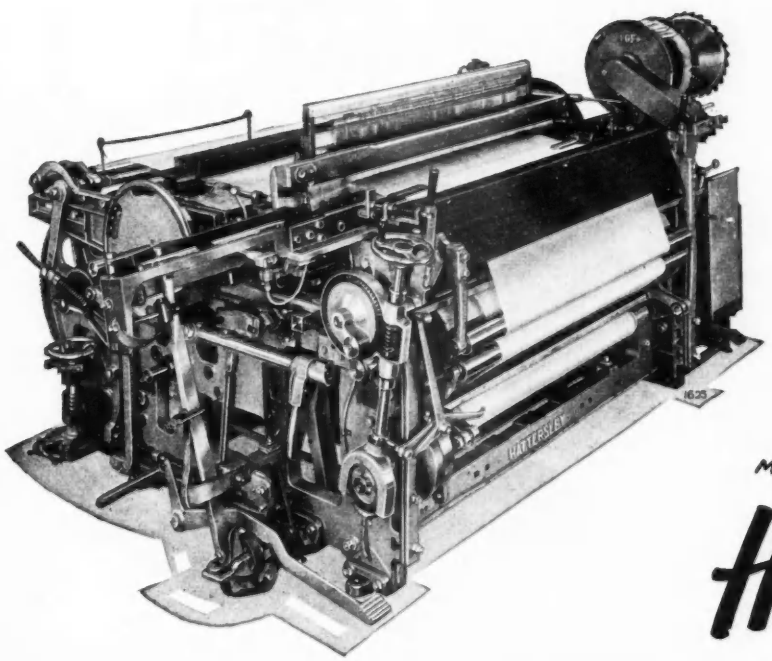

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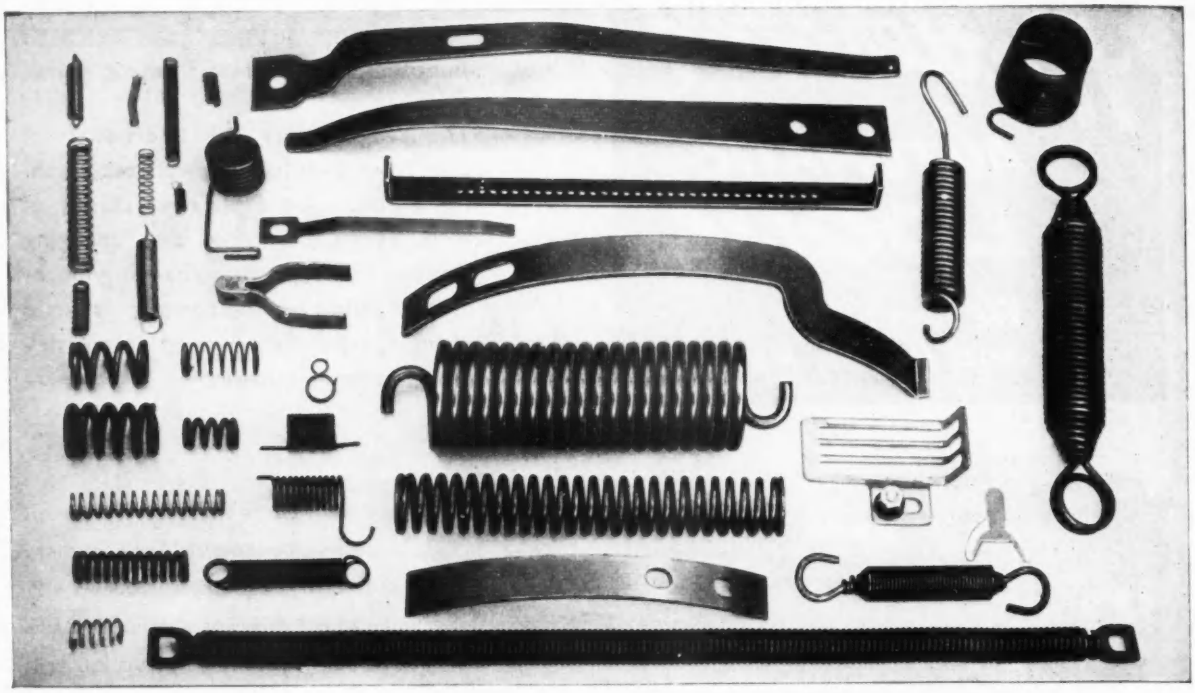

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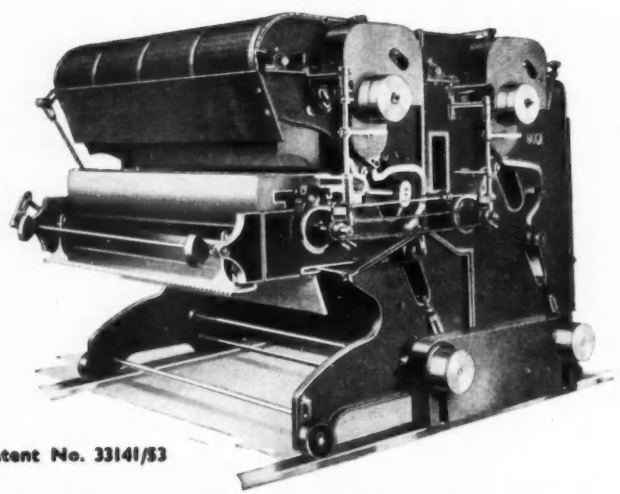

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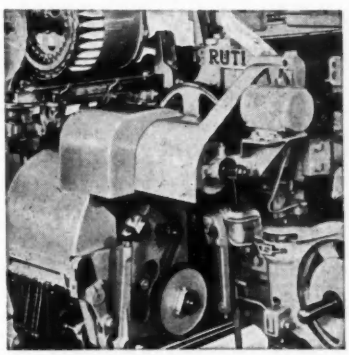

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MATERIALS - PROCESSES - PRODUCTION - MANAGEMENT

NO. 1006. VOL. 84 - OCTOBER 1958 - MONTHLY Two Shillings and Sixpence

CONTENTS

ARTICLES

	Page
ECONOMICS, RESEARCH, ADMINISTRATION	
Complex Yarns and Simple Weaves	493
Spirality in Effect Threads in Weaving	494
New Mercuryless Diaphragm Meter	496
Canadians Improve Nylon Yarn Packing	497
FABRICS AND DESIGN	
Distinctive Worsted Suitings	499
Contemporary Tapestries	508
MACHINERY, MANAGEMENT AND PROCESSES	
Technique of Twisting-in on Looms	500
Special Shears and Cutters for Twisting	502
Breakdown Motions for Twisting	503
Mesta and Roselle as Jute Substitutes	504
Fibre Losses in Carding Mesta, etc.	506
Results of Blending Trials with Mesta, etc.	507
Insulation Testing on Machines and Wiring	509
Location of Faulty Wiring	510
New Homogeneous Acid Milling Dyestuff	511
Dynamic Mechanical Properties of Wool	512
Mechanics of Twisted Yarns	513
Characterisation of High Speed Behaviour of Yarns	515
Tensile Properties of Fibres	516
Properties of Chemically Modified Cotton	518
Induced Draught Cooling	519
P.T.F.E. Dispersion Coatings	519
Electric Lifting Equipment	520
Floor Surfacing Compound	520
Flexible Doors	521
Battery Pallet Truck	521
TEXTILE COLOURIST AND FINISHER	
Reactive Dyes for Cellulose Fibre Goods	522
Combining a Dye with Cellulose Fibres	523
Recent Developments in Reactive Dyes	524
Fixation of Procion Dyes	525
Padding Cellulose Fibre Cloths	526
Cyclic Ethylene Urea Imidazolidone	527
Derivatives of Cyclic Ethylene Urea	528
New Heat Shaped Textile Fabrics	529
Cotton Industry in World Economy (Review)	530
Dry Cleaning Technology and Practice (Review)	530
Chambers Technical Dictionary	530
Trade Literature	531
MARKET INTELLIGENCE	
Export Opportunities	532
Cotton Yarn and Cloth Markets	533
British Wool Market	533
Linen Trade Review	534
Jute Fibre, Yarn and Fabrics	534
Man-Made Fibres and Fabrics	534
Notes and News	535
New Companies	536
Recent Textile Patents	537

NOTES OF THE MONTH

World's Cotton-Industry Leaders Meet	491
Flax Canvas Development	492
Japan: Market for Woollens and Worsteds	492

THE TEXTILE MANUFACTURER (*Incorporating* TEXTILE INDUSTRY AND EXPORTER, THE TEXTILE MACHINIST, THE HOSIERY, LACE AND SILK MANUFACTURER, *and* THE TEXTILE COLOURIST) is published on the first Monday of every month.

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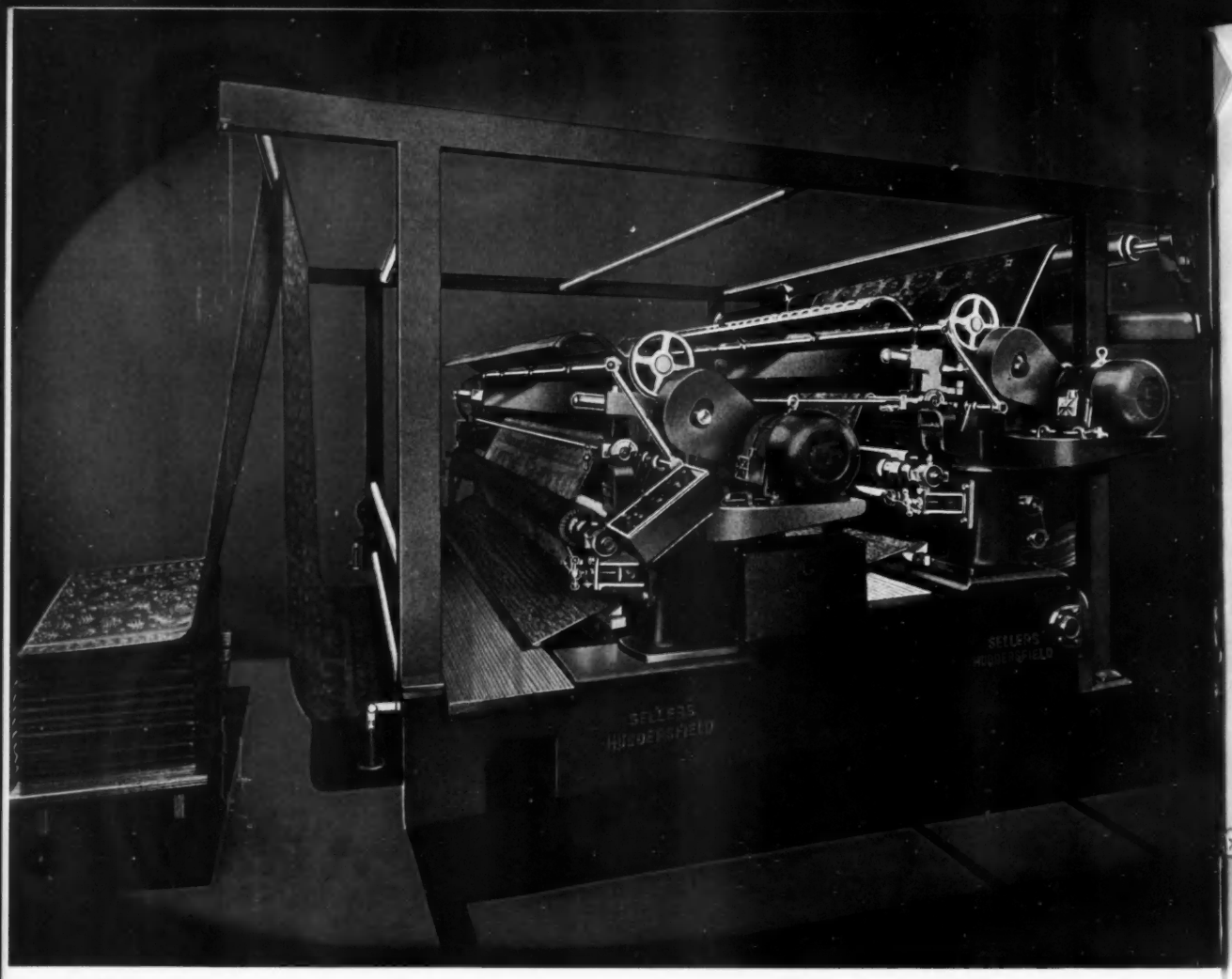

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Notes of the Month

WORLD'S COTTON INDUSTRY LEADERS MEET

THE leaders of the cotton textile industries of Western Europe, the United States of America, Japan, the United Arab Republic and Mexico met in Stockholm, Sweden, during the last week of August at the annual meeting of the International Federation of Cotton and Allied Textile Industries. Approximately 100 delegates attended. The meeting was held at the invitation of the Swedish Cotton Industry Association and the president of the International Federation, Mr. W. T. Winterbottom (U.K.) was in the chair. The meeting took note of a report on the practical implications for the cotton textile industries of the European Economic Community, particularly with regard to the gradual reduction of tariffs and the elimination of quotas among the Common Market countries. It also considered the financial aspects of the Rome treaty, i.e. the provisions concerning taxation and rates of exchange. The Federation has set up a special independent research group, which will continue its studies of the effects of the Common Market on the cotton industry. The Federation recommends that a uniform tariff nomenclature regarding the cotton textile industries should be established within the member countries of the Common Market.

Raw Cotton Export Policies: One of the most important items on the agenda was the discussion of the raw cotton export policies of cotton growing countries, in particular the United States of America. It was emphasised that sudden arbitrary changes in export selling prices, export taxes or rates of exchange as well as the existence of two-price systems contributed to the prevailing uncertainty in the cotton consuming world. The latest amendments to the United States farm legislation were considered; the Federation decided to approach the responsible Authorities in the United States in that connection, and a statement on this subject will be issued shortly. The Federation also discussed recent developments in ocean freight rates for raw cotton. A resolution was adopted which recognises the importance of the Conference freight system in assuring regular and frequent sailings, thus allowing a constant and even flow of cotton. However, the Federation draws the attention of the members of the Conference Lines to the necessity of always adopting a realistic attitude when alterations in freight rates are considered.

New Techniques of Cotton Marketing: The Federation also examined various new methods of cotton marketing with the help of mechanical aids. The newly proposed rules of arbitration on the basis of Micronaire readings were discussed with a special delegation from the American Cotton Shippers' Association. It was agreed that the rules of arbitration drafted by the International Federation should be examined in detail by raw cotton shippers in the United States, before any decisions are reached. The report on the results of an elaborate testing scheme, which was carried out with the Shirley Analyser in 14 different mills and laboratories in seven countries, was also considered. The results of this testing scheme revealed that it should now be possible to buy raw cotton on the basis of trash content, using the Shirley Analyser for arbitration purposes, but only if so desired and mutually agreed upon between buyer and seller. More experience should be gained with such practice before Shirley Analyser clauses can be included in raw cotton contracts.

Productivity Comparisons: The Federation continues with its work on the development and application of a new method for measuring labour productivity in cotton spinning mills. Several member countries have already had considerable experience with this method and plans are being made for an international comparison of productivity data.

Standardisation: A Technical Sub-Committee reported on various matters in connection with standardisation and fibre testing. The Federation adopted a resolution regarding the introduction of TEX, the new universal yarn counting system, stating that as far as the cotton and allied textile industries were concerned, the introduction of stage one of the system could start without further delay, prior to the suggested date, so that by January 1, 1960, stage one would be completed and stage two could begin. In order to accelerate the widespread application of TEX, the Federation recommends that further efforts should be made on an educational level, viz. in schools, colleges, universities and other institutions of learning, so that the new generation of textile engineers and technologists will be brought up thoroughly familiar with the TEX system. The Federation urges the educational authorities and their respective governments to introduce TEX in the various establishments as soon as possible. At an industrial level, the national Member Associations of the International Federation agreed to promote the practical application of

Textile Machinery Exhibition

During the exhibition, October 15-25, "Textile Manufacturer" will occupy Stand No. 2509—Tel. No. East 3251—Ext. 244.

TEX in the industries of their respective countries. The Federation also endorsed a recommendation by the International Organisation for Standardisation regarding methods for determining commercial weights of textiles and the definitions of commercial weight, commercial regain and commercial allowance.

Man-Made Fibres: In view of the importance which the man-made fibres have attained as a complementary raw material used by the cotton textile industry, it was decided that a permanent Committee for Man-Made Fibres should be established within the International Federation of Cotton and Allied Textile Industries. This Committee is to deal with the technical and commercial aspects of man-made fibres, in so far as they are of interest to the cotton industry. The Committee will first undertake studies of the following subjects: (*a*) terminology of man-made fibres; (*b*) establishment of standards for the man-made fibres; (*c*) the price situation; and (*d*) labelling of textile goods. Close co-operation will be established with the organisations representing the producers of man-made fibres and their respective trade associations.

Statistics and Administration: The meeting also agreed on several measures designed to improve the Federation's administrative and statistical services. In future the statistical surveys published by the Federation will be co-ordinated with those published by other agencies, particularly the International Cotton Advisory Committee and the Textiles Committee of the OEEC.

Market Research and Sales Promotion: In conclusion the meeting devoted a special session to activities in market research and sales promotion, which had been carried out in many consumer countries throughout the world, and which had strengthened cotton's competitive position in the textile trade. A new documentary film entitled "Cotton—Nature's Wonder Fibre," which was produced by the Cotton Council International, was shown.

Several social functions were arranged in connection with the meeting, including an excursion by boat to the archipelago and an official banquet in the City Hall of Stockholm. The next annual meeting of the International Cotton Federation will be held in Vienna, Austria, from September 21 - 26, 1959.

* * *

FLAX CANVAS DEVELOPMENT

AFTER considerable research a Scottish flax canvas manufacturing firm have developed in their own laboratories a new type of protection against sulphuric acid attack on cloth. The new development is reported to increase the life of canvas on oil-burning ships by three times when exposed to acid burns. The firm, Boase Spinning Co. Ltd., Rockwell Works, Dundee, found that like other canvas manufacturers they were receiving reports from owners and masters of oil-burning ships of the rapid destruction of canvas covering hatches, lifeboats, machinery, and other shipping equipment. The destruction appeared to be caused by small burns, and was proving a recurrent nightmare to those in charge of stores. Some shipowners tried to seek protection by having their canvas sparkproofed but this was of no avail. They misapprehended the cause of the burns which were not due to red-hot particles scorching the canvas. The damage was done by the formation of acid spots. The sooty particles from the smoke stack of oil-burning ships contain sulphur, which is deposited on awnings, boat covers, hatch tarpaulins, and other canvases. Eventually it comes into contact with water which develops dilute sulphurous and sulphuric acids. These become highly concentrated and cause the burns. No textile material is immune from this type of damage. The virulence of the damage is caused not merely by acid alone but by acid in conjunction with that most degrading of all influence, ultra-violet light.

After finding the cause, Boase Spinning Co. laboratories formulated a proofing which, in addition to a tough outer skin of plastic, also incorporates acid-neutralising chemicals within the fibres of the flax canvas. Thus, even if any acid should eventually penetrate the plastic skin, it then encounters a second line of defence in the actual fibres of the cloth. Water repellent and rot-resisting agents are also incorporated in the canvas. The Boase Spinning Co. have thus designed one of the best protected canvas for ships' use that modern science has so far evolved. The cost is between 20 and 30% more than ordinary canvas, but it is claimed to last far longer. One sailmaker's verdict after years of trials is that the new canvas, named "Aptex," gives a serviceable life three times longer than untreated canvas under severe conditions of acid contamination.

* * *

JAPAN: MARKET FOR WOOLLENS AND WORSTEDS

IN spite of great improvements in the quality of goods produced by the Japanese woollen industry (which now has 497 worsted and woollen spinning mills and 3,255 weaving establishments with a labour force of some 132,000 persons), British woollen cloths still command a good market in Japan and can be sold at handsome profits, according to a report prepared by the British Embassy in Tokio, published by the Export Services Branch of the Board of Trade. The Japanese, however, are interested only in British cloth of the highest quality; their own industry is capable of meeting the demand for medium and lower grades. Although the production of synthetic fibres has made rapid strides, the demand for wool by Japan's increasing population remains fairly constant. Thus, the quota provided annually for the import of woollen fabrics under the Anglo-Japanese trade arrangement has been fully utilised. The figure for the current period expiring March 31st, 1959, is £2·8 million. Further improvements in the quality of Japanese woollen fabrics may be expected but as long as import quotas are available, a fair section of the public, which has long recognised the outstanding qualities of British cloths, will continue to purchase them.

Some importers do not use all the foreign exchange allocated to them and are often ready to accommodate other importers, by giving them the right to import goods under their quotas at a premium. Foreign exchange certificates are not transferable, so that the firm offering such accommodation must obtain the import licences and the goods on arrival are handed over to the firm who has been accommodated. The commission on such business is usually 25% and is required to be paid in advance, before orders are placed with U.K. suppliers. This additional cost is of course passed on to the consumer. It will be gathered from the above that, with the exception of the comparatively modest return to commission agents, there is considerable profit-taking all along the line; but as long as the consumer is able and willing to pay high prices, keen interest in handling British woollen fabrics will remain. A cloth which sells at 40s. per yard f.o.b. U.K. port may ultimately be sold by a tailor at £7 per yard. A fancy worsted suiting of Japanese manufacture, costing about 36s. a yard ex-factory would be wholesaled at about 38s. and retailed at between 49s. and 64s.

Complex Yarns and Simple Weaves

Interesting and varied surface effects can be obtained on cloths by exploiting the different properties and qualities in effect threads. Wherever possible, plain weave was used in the patterns discussed as it enabled the cloths to be produced on a simple loom with high productive capacity

By A. JOHNSON, M.SC., F.T.I., C.G.I.A.*

ONE objective, ever present in the minds of those responsible for the management of modern textile factories, is to weave the required cloth structure on looms as productive as possible. An ideal loom for such purposes would be the Lancashire tappet with a single shuttle or, at the most, boxed 2/2, but such limitations are very restrictive from the designing point of view and, in effect, lay the responsibility for the surface ornamentation of the cloth on the yarn. Thus, the one who plans the yarn structure is really the designer of the cloth, although it is usually the fabric designer who suggests yarn development rather than the yarn manufacturer who reaches out to modify cloth structure.

The importance of folded yarns in the simplification of weaving cannot be overestimated and nowadays this field of development has greatly extended due to the suitability of fine denier high tenacity filaments for foundation or core threads. The latter can easily be combined with thicker effect threads of continuous filament or staple fibre and are capable of moulding and fixing the effect threads in suitable postures and yet remaining practically hidden in the cloth.

* *Associate Professor of Textiles, University of Technology, Sydney, Australia.*

Combining Threads of Widely Differing Denier

One very successful method is to combine a highly twisted effect thread with a fine core in such a way that the former is without twist in the twofold. For instance—a 60s worsted count effect thread, with 20 t.p.i. "Z," can be twisted 20 t.p.i. "S" with a 30 den. nylon. This process has extended the length of the effect thread by untwisting and spiraling it around the core and the latter has decreased in length due to the insertion of twist (yarns 1-5). If the core is unable to bear the strain of the twist unloaded by the effect thread as it approaches the completely detwisted form, it can be relieved by pre-twisting in a direction similar to that in the crepe twist or, in other words, opposite to that used in folding. For example, 280 den. with 35 "S" could be twisted with 45 den., 20 "S," the twofold having 35 "Z" and theoretically leave the filaments of the 280 den. without twist in the twofold and insert 15 "Z" in the core. (yarns 6 and 7 are in this class). It should be realised, however, that when the aim is to spiral the effect thread around the core this modified method does not accentuate the spirality as much as the more simple one where the core in its original state is twistless. In the latter case the maximum core contraction takes place during folding, whereas in the modified method the core first extends to relieve the strain and then contracts a little during the second phase of twisting. The insertion of twist into both components, however, increases costs and it may be advisable to aim at those effects obtained from core threads with minimum twist. The results can then be analysed and pretwisting the core carried out only if a particular effect cannot be obtained otherwise.

Number of Effect Threads

Two or more effect threads can be used for diversity and yarns 6 and 7

Pattern 1

Pattern 2

Pattern 3

Pattern 4

Pattern 5

Pattern 6

were made on these lines, both threads being completely detwisted to accentuate the effect. The scope offered by different qualities in the effect threads and especially with fibres sensitive and insensitive to the finishing process, is practically unlimited and worthy of a very systematic investigation. In passing, it was noticed that when two effect threads with the same twist are used they tend to merge at irregular intervals when detwisted. This effect can be prevented by slightly varying the twist.

Spirality in the Effect Threads

In order to obtain the maximum spirality of the effect threads with the minimum complications, the amount of original twist must be carefully considered *before* combining with the core. In general, the most effective yarns are obtained when at least one of the effect threads is near maximum twist so that its length is extended as much as possible in detwisting. It is, of course, possible to enhance spirality by increasing the length advantage of effect thread to core by feeding the former at a higher rate through a separate pair of rollers, but again this is regarded as a complication to be avoided if possible as it adds to cost and can lead to unstable yarn and cloth. Care must be taken to ensure that one of the effect threads is practically without twist when finally combined with the core. The three reasons for this are:—

(1) **To realise the greatest length advantage in the effect thread and the greatest contraction of the core.**

(2) **To impart a softer handle through the de-twisted effect threads, and—**

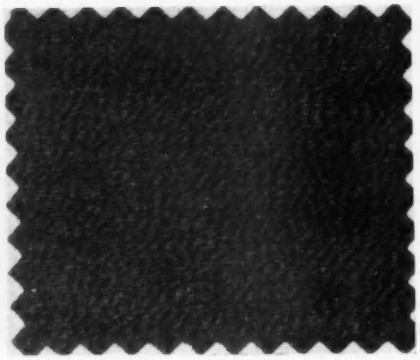
(3) **To reduce the tendency of the effect thread to slip on the core.**

In a further development, the twist in the effect thread was supplemented in the doubling process so that the latter added twist to both components. This was done in yarns 8 and 9 where 20 turns in the 48 worsted count in its original form is increased to 35 by twofolding. This places them in the crepe-class and considerably reduces the fullness in handle of the cloth.

Yarn Structures

The patterns from the yarns listed overleaf are described to show how they provide interesting and varied cloth surface effects. Wherever possible, the plain weave was used, partly because this enabled the cloth to be produced on a simple loom with high productive capacity. This limitation has a still more significant aspect inasmuch as it prevents the use of complicated designs which rarely form a happy combination with complex yarns. In fact, a good maxim to keep before a designer is "simple yarn, ornate designs and fancy yarns, simple weaves." All the fabrics were

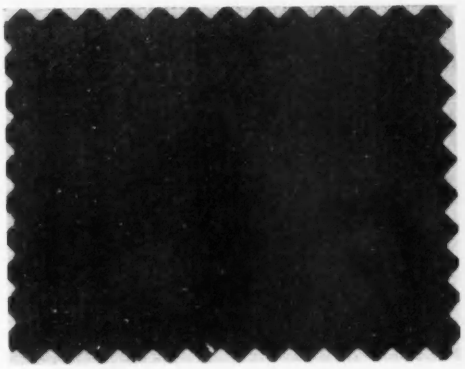
Pattern 7



Pattern 8

Pattern 9

(1)	500 den., viscose, 18 "Z" 60 den., high tenacity viscose	18 "S"
(2)	60s w.c. wool 30%, "Fibro" 70%, 20 "Z" 30 den., nylon	20 "S"
(3)	12s w.c. "Fibro" 70%, wool 30%, 15 "Z" 30 den., nylon	15 "S"
(4)	10s w.c. "Fibro," 13½ "Z" 30 den., nylon	13½ "S"
(5)	10s w.c. "Fibro" 70%, wool 30%, 13½ "Z" 30 den., nylon	13½ "S"
(6)	Two—75 den. (19 fil) acetate, 55 "S" 30 den., high tenacity viscose 20 "S"	55 "Z"
(7)	Two—140 den. (28 fil) acetate 35 "S" 45 den. high tenacity viscose 20 "S"	35 "Z"
(8)	48s w.c. "Fibro," 20 "Z" 30 den., nylon	15 "Z"
(9)	48s w.c. "Fibro" 70%, wool 30%, 20 "Z" 30 den., nylon	15 "Z"



Pattern 10

given a plain finish which allowed the maximum width and length contraction and avoided unwanted shrinkage in made-up garments.

Cloth Structures

Pattern 1.—Warp — 500 den. viscose, 18 "Z"; 60 den. high tenacity rayon — 18 "S"
Ends — 36 per in.
Weft — as warp.
Picks — 36 per in.
Weave — plain.
Reed 40 in. — grey 39 ins. — finished 37 ins.
Finished weight — 9/10 ozs.

This cloth has a mottled surface effect of a type not often seen. The handle is crisp, but might be softened by modifications in finishing which have not been tried.

Pattern 2.—Warp — Two 75 den. (19 fil) acetate 55 "S"; 30 den. high tenacity viscose 20 "S" — 55 "Z"
Ends — 60 per in.
Weft — as warp.
Picks — 50.
Weave — plain.
Width — reed 40 ins. to finish 36 ins.
Weight — approximately 5 ozs./sq. yd.

A fabric with a cool, crisp handle and strongly crease-resistant. The yarn structure appears to allow pairs of warp threads intermittently to merge and separate to form a lace-like effect, which though small, gives remarkable character to the cloth.

Pattern 3.—Details as Pattern 2 with the exception of weave, 2/2 twill and picks, 50 per in. As would be expected the material is more supple than pattern 2, but otherwise it contains the same characteristics. The cloth has been designated by one member of the haute couture as a good imitation linen, a comment which applies in greater or lesser degree to patterns 2 to 7.

Pattern 4.—Details are similar to pattern 3—with the exception of the design which is an eight-end fancy. The comments relating to Pattern 3 are applicable to this fabric.

In pattern 5 the irregular "lace" pattern to which reference was made in pattern 2 is present, but in a much less obtrusive form. This produces an appearance still closer to linen's irregularity and the increased weight makes it suitable for lightweight costumes.

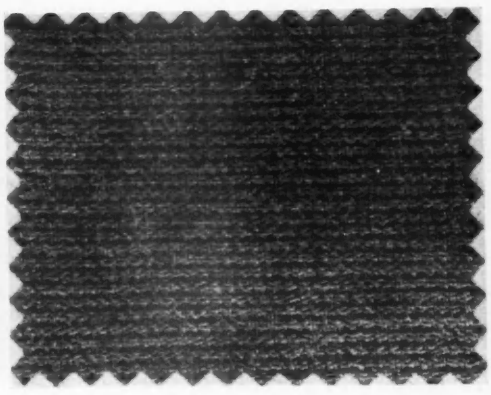
Pattern 6.—2/2 twill weave with 56 picks per in., otherwise details similar to previous pattern 5.

Pattern 7.—Structure similar to pattern 5 but eight-end fancy weave and 44 picks per in.

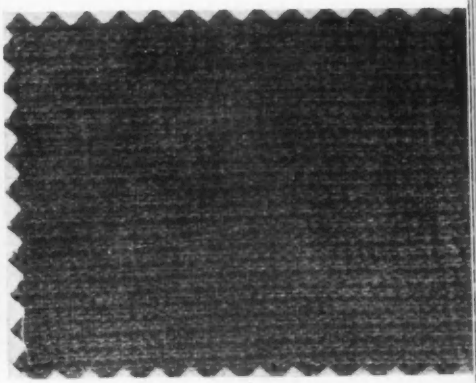
In the next range the warp and weft of each pattern is different. Plain

Pattern 5.—Two 140 den. (28) acetate, 35 "S"; 45 den. (12) high tenacity viscose, 20 "S" — 35 "Z"
Ends — 60 per in.
Weft — as warp.
Picks — 40 per in.
Weave — plain.
Width — reed 40 ins. for 37 ins. finished.
Weight — approximately 60 ozs./sq. yd.

Pattern 11



Pattern 12



Pattern 13

weave has been used without exception although its customary "basket" interlacing is hidden in many instances by the complex-yarn structure.

Pattern 8.—Warp — **60 w.c. wool, 30% "Fibro," 70%, 20 "Z" 30 den. nylon.**
Ends — **72 per in.**
Weft — **12 w.c. wool 30%, "Fibro" 70%, 15 "Z" 30 den. nylon.**
Picks — **38 per in.**
Weave — **plain.**
Width — **reed 40 ins., grey 38, finished 36 ins.**

A very sound cloth with a surface reminiscent of morocain. Each yarn could, with advantage, be used across a plain warp say in sateen order or as warp and weft in a more loosely set structure.

Pattern 9.—Differs from the foregoing only in weave (eight-end sateen) and picks per in. (54).

Pattern 10 produces a very attractive crepe fabric in which vertical intermittent patterning is balanced by the transverse lines of crepe weft differing in direction of twist.

Pattern 12 breaks away from all-over effects of previous examples and forms ribbed pattern.

The mixture of wool and "Fibro" in pattern 13 produces a softer fabric than pattern 6 and also assists in secreting the nylon base.

There is little doubt that yarns in this category have interesting possibilities in fabric structure. They are not easy to produce however as, for example, it requires great patience to determine the maximum twist an effect yarn can contain in its original form yet which will allow it to detwist when combined with a given core. Furthermore, many trials must be made to find the minimum size of core-thread strong enough to carry a combined yarn through the strain of processing and having found this to determine whether limitations in machinery or operative skill make it unwise to plan production to this specification. Such problems are inherent in all business projects, however, but in the present case if surmounted, at least simplify to a great extent the mechanisms needed in weaving to produce interesting surface effects on fabric.

(Acknowledgment is paid to Courtaulds Ltd., for production of yarns and fabrics.)

Pattern 10.—Warp — **Two 75 den. (19 fils) acetate, 55 "S"** .. } **55 "Z"**
30 den. (12 fils) high tenacity rayon 20 "S" }
Ends — **60 per in.**
Weft — **2 picks, 200 den. viscose crepe, "S"**
2 picks, 200 den. viscose crepe, "Z"
Picks — **50 per in.**
Weave — **plain.**
Width — **reed 40 ins., grey 38, finished 36 ins.**

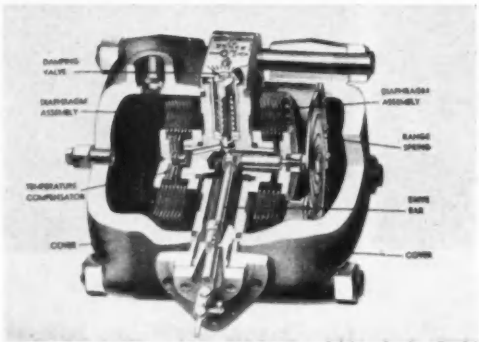
Pattern 11.—Warp — **Two 140 den. (28 fils) acetate 35 "S"** .. } **35 "Z"**
— 45 den. (12 fils) high tenacity rayon 20 "S" }
Ends — **60 per in.**
Weft — **2 picks, 200 den. viscose crepe "S"**
2 picks, 200 den., viscose crepe "Z"
Picks — **40 per in.**
Weave — **plain.**
Width — **Reed 40 ins., grey 39, finished 36 ins.**
Rather heavier fabric than pattern 4.
Would be attractive with one crepe weft although this might limit the amount of surface "pebble."

Pattern 12.—Warp — **48 w.c. "Fibro," 20 "z"** .. .. .. } **15 "Z"**
30 den. nylon .. .. }
Ends — **52 per in.**
Weft — **2 picks as warp.**
2 picks—10s w.c. "Fibro" 13½ "Z" .. } **13½ "S"**
30 den. nylon .. .. .. }
Picks — **48 per in.**
Weave — **plain.**
Width — **reed 40 ins., grey 38, finished 36 ins.**

Pattern 13.—Warp — **48 w.c. "Fibro", 70%, wool 30%, 20 "Z"** .. } **15 "Z"**
30 den. nylon .. .. }
Ends — **52 per in.**
Weft — **2 picks — as warp.**
2 picks — 10s w.c. "Fibro" 70%, wool 30%, 13½ "Z" .. .. } **13½ "S"**
30 den. nylon .. .. }
Picks — **50 per in.**
Weave — **plain.**
Width — **reed 40 ins., grey 38, finished 36 ins.**

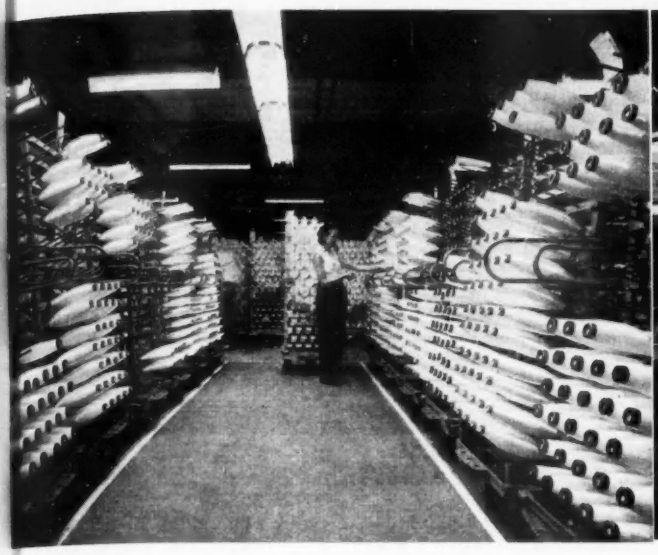
New Mercuryless Diaphragm Meter

A NEW mercuryless meter to measure a range of differential pressures from 20 to 200 ins. of water at static pressures up to 2,000 p.s.i., is announced by Foxboro-Yoxall Ltd., Redhill, Surrey. It has a number of features: i.e. a frictionless flexure—pivoted drive unit of exceptional sensitivity; positive protection against over-range with no zero shift; a simple method of range change.



A cut-away showing interior view of Foxboro-Yoxall's Type 37 new mercuryless diaphragm meter

The illustration shows the inner construction of the chamber assembly of the new meter. A flexible diaphragm assembly is used for the measurement of differential pressure. Preformed discs are welded by a special process and shaped to nest into the adjacent disc and each is welded to a spacing ring. Excess pressure in either chamber will compress the diaphragm assembly until each pair of discs is nested and the spacing rings have contacted to form a metal to metal stop. The drive unit is of solid rods joined by a metal flexure and forms a direct connection between the diaphragm assembly and the pen lever. The fulcrum is formed of two similar flexures and the seal is a flexible bellows capable of withstanding pressures 50% above the meter rating. This drive transmits the smallest measurement changes to the pen with accuracy.



Nylon yarn trucks are here shown in the segregation section, where yarn is classified before going to the final inspection area

The long motorized belt shown above has double check inspection stations and ends at a push button controlled gluing operation

Canadians Improve Nylon Yarn Inspection and Packing

By J. GRINDROD

GREATER speed and efficiency in nylon yarn inspection and packing methods have resulted from a detailed method study at the Du Pont Company of Canada nylon plant at Kingston, Ont., undertaken recently by Mr. P. H. Skelton, plant methods and planning supervisor. More effective use of personnel and saving of time has been achieved through the streamlining of materials flow and reduced manual handling of cartons and new type export containers have been evolved.

One of the principal products of the Canadian Du Pont Kingston works is nylon yarn on bobbins which are wound in the manufacturing area and transported to the inspection area on trucks by tractor train. The yarn is then packed in cartons weighing about 75 lbs. Although the volume of production is sufficient to present a handling problem it is not high enough to warrant extensive materials handling arrangements and any improved system had to be justified by the savings which would be gained.

Hitherto, yarn was routed directly from the manufacturing area to the inspection stations where there was insufficient conveyor space to accommodate the number of cartons required for packing. This meant that some cartons had to be packed on the floor and then lifted on to the conveyor. Inspectors packed standard material and rejected all defects which went to an upgrading station to be dealt with. Packed cartons moved down a motorised conveyor to weighing and checking stations, following which the tops were glued by hand, the bottoms having been stitched before packing. Heavy handling was involved in inverting the cartons to hold the flaps shut until the glue had set and reversing them again for palletising.

Under the newly installed systems, operations are built around a horseshoe shaped, motorised roller conveyor more than 350 ft. long. Along one side of this are 14 inspection stations and a quality audit point. On the other side are weighing and checking stations and a carton gluing machine. Between the manufacturing area and the inspection stations a segregation station has been placed where previously identified defective bobbins are removed from the trucks and sent for repair. There are two trucks for each type of yarn being processed and defective bobbins are consolidated on the proper trucks.

The production trucks then move forward to an inspection station, where all the bobbins are finally inspected, occasional minor surface defects such as dust being removed by an air stripper before they are packed into cartons. Though only one type of yarn is packed at a time at each station, the inspector has to pack to a number of different categories and the stations are, therefore, fitted with four packaging conveyors which lead to the motorised conveyor on which is installed the quality audit station. Here, samples of bobbins from each carton are again inspected and if two rejects are found from any inspector within 60 consecutive cartons, then all that inspector's output is re-inspected and any necessary disciplinary steps taken.

Cartons then move round the horseshoe bend, which is a gravity roller section constructed of tapered rolls that feeds a second motorised roller conveyor leading to the weighing station and a weight and identification checking station. Here, cartons to be glued are sent on to one of three lagging conveyors on which they are

grouped according to size. When one lagging conveyor is full, the checker presses a button on her control panel which automatically discharges the cartons then in the gluing machine, adjusts the machine to the new size of carton on the lagging conveyor and depresses a stop on the latter to release the flow by gravity of new cartons for gluing.

Though of the standard type, the gluing machine can, however, accept cartons varying in height by plus or minus ½ in. and in width by plus or minus 2 ins., without the need to make any alterations to the size of the setting. This is accomplished by having extra long springs on the compression rollers and spring-loaded side rails in the sealing unit. The cartons are then removed by hand and palletised.

At any one time, up to 70 different commodities may be inspected requiring up to 70 pallets to be located close to this conveyor. Pallets are removed to the storage area by hand pallet truck or fork lift truck. Until recently, exported nylon bobbins were packed in plywood cases, into which four domestic type cartons were packed. In the competitive trade conditions of recent years, a superior and less expensive packing arrangement had to be found and the outcome of investigations has been the development of a domestic type 350 lbs. test, single-wall, corrugated carton, into which is placed a special type divider, which are made up of four scored and slotted tubes fitted together to give 25 "egg-crate" type sections for the bobbins. This complete carton is then placed in a 350 lbs. test, weatherproof corrugated carton. This has proved economical, easy to assemble and good protection.

Speed Reduction Pulleys

BUILT to give long service life with substantial saving of space, time, power and maintenance the "Andantex" speed reduction pulley is basically designed on the familiar sun and planet gear system, but is claimed to have many advantages over the conventional method. An interesting feature of the unit is the method of keying the planet pinions to their respective shafts. This method, the

makers point out, has been invented mainly to overcome the difficulties experienced in equilibrating the load when more than one multiple gear train is fitted round the central sun gears.

If one set of planet pinions transmit a given force, then "X" planet pinions will transmit "X" times that amount. This, however, only obtains if the gear teeth bear upon each other simultaneously. Using steel keys and keyways one set of planet pinions can be easily fitted, but assembly of the second set requires very accurate setting of the key-way position. In the patented method used for the "Andantex" pulley the reduction unit is permanently assembled. The pinions are mounted on their shafts and left free to rotate so that they can take up their natural position. Special adaptors are used in the position of the planet shaft bearings thus enabling the planet gears to be pre-loaded and set in their correct position in relation to the central sun gears. This assembly now forms a mould which is pre-heated and liquid nylon is injected by a specially designed nylon injection press. The adaptors are thus removed and the correct bearings inserted. Slight elasticity in the nylon allows the bearings to give the pinions sufficient working clearance and thus equilibrates the load upon them.

Silent running and efficiency of gear transmission depends upon correct shape and hardness of contact faces on the gear teeth. All gears used in the manufacture of the pulleys are of the single helical type made from nickel-chrome steel, accurately cut, hardened and profile ground to very fine limits. Only ball and roller bearings are used, there are no bearings of bronze or brass and high quality oil seals are incorporated.

The "Andantex" reduction pulley provides a method of reversibility not dependent upon the addition of extra gears or the crossing of a belt. The direction of rotation is governed by the gear ratio employed and can, therefore, be arranged as required. The range of speed reduction obtained is very varied—in fact twenty-one set ratios are available ranging from 2·79 : 1 to 273 : 1 in cases where the driven shaft rotates in the same direction as the driving shaft. When the driven shaft rotates in the reverse direction the range is from 1·79 : 1 to 272 : 1. "Andantex" reduction pulleys are completely self-contained, the case being used as an oil bath and the whole sealed by high duty oil seals. The pulleys can run without attention for at least 30,000 and possibly 50,000 working hours. They are designated by the degree of torque they will transmit; for example an H.60 unit will transmit 60 lb./ft. torque. "Andantex" reduction pulleys are available in 16 sizes, each of which can be fitted with any of the ancillary attachments, either singly or in combinations, to overcome special transmission problems.

"Andantex" is a registered trade mark and the sole licensee for the manufacture and sale in the U.K. and Commonwealth countries is Furnival and Co. Ltd., Reddish, Stockport, Cheshire.

Distinctive Worsted Suitings

For purposes of detail, the patterns on the facing page have been enlarged approximately 50%. These fine cloths are in every case 100% worsted, except for some of the decoration threads. Manufactured by Parkland Manufacturing Co. Ltd., Greengates, Bradford, they have been selected from four ranges of which brief details appear below:

(1) From the company's APS range, this smart 58 ins. cloth in emerald green, grey and fine subdued scarlet, is 13½-14 ozs.

(2) A design from the EAP range—a lovely small squared effect in lavender and black—58 ins. and 14½-15½ ozs.

(3) Another pattern from the APS range—a neat effect in blue/grey, fawn, black and russet yarns—58 ins. and 13½-14 ozs.

(4) One from the firm's SBP range. A fine silvery stripe on a charcoal ground, also 58 ins. wide and 15 ozs.

(5) Grey, light brown and blue/grey yarns are skilfully employed in this smart selection from the APS range of 13½-14 ozs cloths.

(6) From the SBP range. Another pronounced silvery stripe on a navy/blue ground.

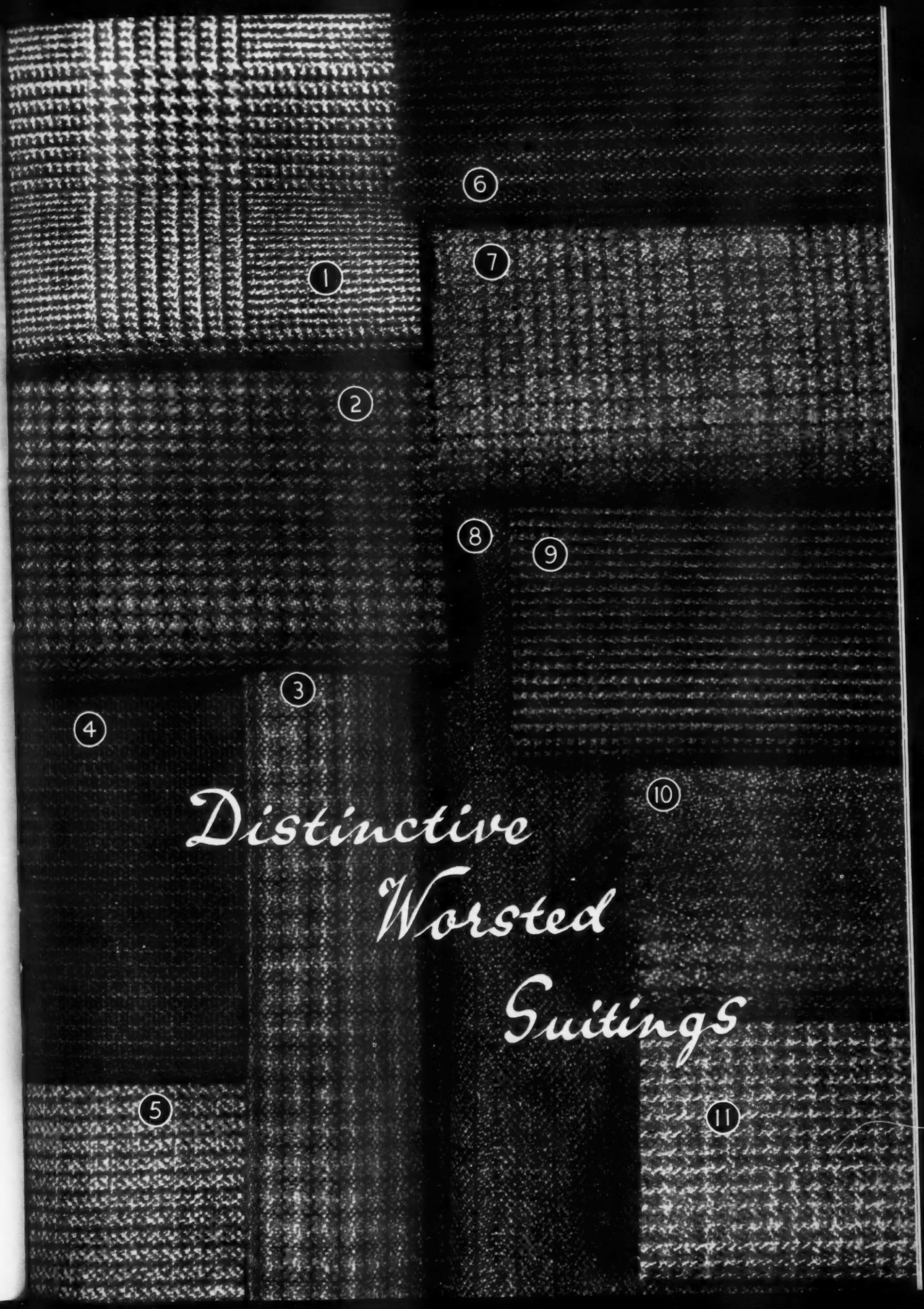
(7) A novel design from the EAP range of patterns. Two shades of grey, with light blue and light brown yarns. 58 ins., 13½-14 ozs.

(8) A double-striped pattern in blue/grey with fine scarlet and white stripe alternating. From the SGK range, it is 58 ins. and 17-18 ozs.

(9) Another from the SGK range in which slate, green and fawn yarns are employed to maximum effect. It is 58 ins. and 17-18 ozs.

(10) Two shades of grey are used in this cloth from the EAP range.

(11) Light blue, white, light brown and green/grey yarns are used in this APS cloth.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Distinctive
Worsted
Suitings

3T CORD

Exclusive Goodyear development means stronger, thinner, more flexible transmission belting.

No splice failure
In construction the cord is wound continuously around two pulleys to produce a truly endless belt.

No ply separation
The single layer of load carrying cords round the pulley together, preventing internal stress.

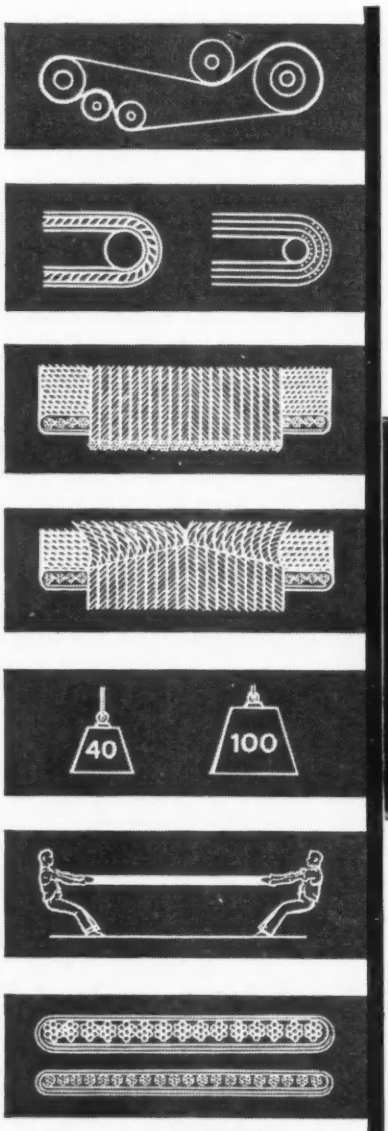
Less lateral movement
To neutralize lateral movement half the cords are twisted to the right and half to the left.

Elastic envelope
Designed to provide high friction surface to grip the pulley and transfer load to the cords.

Stronger 3T Cord
2½ times stronger than cotton and each filament of fibre is continuous, like the cord itself.

Less stretch
Triple Tempering removes surplus stretch but only to a degree where it does not hinder the flexibility of the fibre.

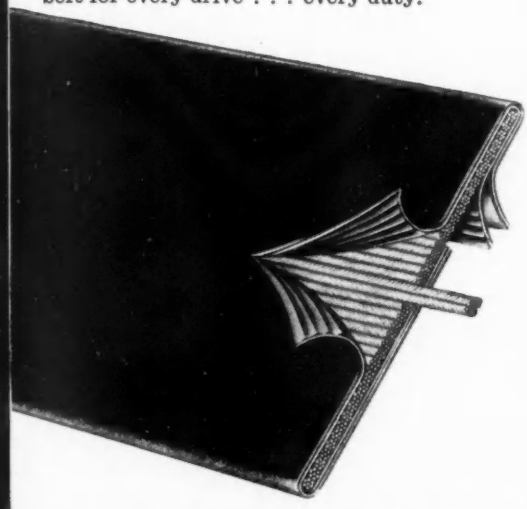
Thinner belt
3-T Cord belt is 25% thinner than belts of equal horse-power rating.



THE amazing new Goodyear 3-T cord process – successfully applied to motor car and commercial vehicle tyres – is also making transmission belts work harder, last longer and cost less for a given horsepower rating.

The synthetic cords are 'triple-tempered' – passed through a process at a controlled Tension and Temperature for a specific Time – to give them maximum strength and flexibility, minimum stretch. The result is that you can use a thinner belt – get improved flex life, longer wear, more efficient transmission and reduced maintenance.

There's a Goodyear 'job-designed' transmission belt for every drive . . . every duty.



NEW HD ENDLESS CORD BELT

The synthetic 3-T cords are *2½ times stronger* than cotton. This means longer service at lower cost on any drive. The special design of the belt eliminates splice failure and ply separation. HD Endless Cord costs no more, yet you get much higher horsepower ratings, better service all round.

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The Technique of Twisting-in Nylon and "Terylene" Warps

The usual method of twisting-in is described in detail, together with suggested modifications, including a synopsis of breakdown of motions in which special scissors or shears are employed

By I. LAIRD

THE ever-increasing use of synthetic yarns like nylon and "Terylene" for warp yarns has created a problem in the twisting-in of warps, because most of these yarns are too strong to be cut by hand in the normal twisting-in operation. Some mills have overcome the difficulty by installing a warp-knotting machine that has mechanical cutters, but small weaving sheds have not sufficient work to justify the capital cost of such machines. The latter will be discussed in a subsequent article. This article describes a method whereby hand twisters-in can twist the strongest yarns by using special scissors or cutters to cut the ends immediately before twisting. The usual method of twisting-in is described in detail below, and the modifications suggested will be explained subsequently.

Normal Twisting-in Method

The warp in loom is woven up as far as possible, and the twisting-in lease rods are inserted in end-and-end order. The rods are pushed up to the heald eyes of the back shaft, and the rods are kept in position by means of sheaths or cords. The warp ends of the felled warp are then cut in knots of about 3 ins. wide (in the harness), and the knots are neatly tied up to the lease rods at the harness as shown at Fig. 1. The ends are cut as near to the warp beam as possible so that a stretch of yarn about 24 ins. from the heald eyes is obtained. The new warp beam, Fig. 2, is then prepared by (*a*) fitting a weight or weights round the ruffles in order to prevent the warp swaying or moving forward during the twisting-in, (*b*) inserting lease rods and securing them from slipping out of the warp lease, (*c*) positioning the rods at elbow-height for twisting-in, and (*d*) the warp sheet is divided into yarn knots of about 3 in. wide to coincide approximately with the yarn knots already tied-up at the harness lease rods; each knot is brushed straight and is tied up neatly against the rods of the new warp. The sketch, Fig. 2, shows a method of suspending two weights by a double cord A and B, attached to the temple bar R. As the weights keep the double cords under tension, the

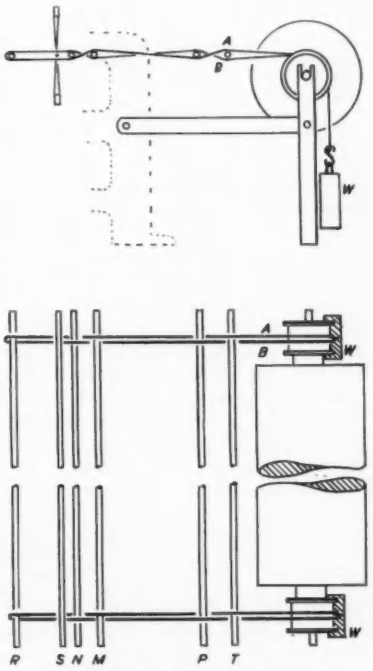


Fig. 2. Twisting rods to secure lease-rods. A and B—lease-rod cords. W—weights. R—temple bar. S—stave. N.M.P. and T.—lease-rods.

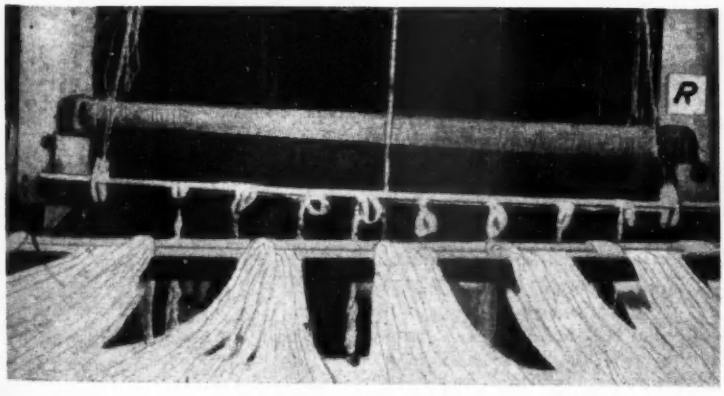
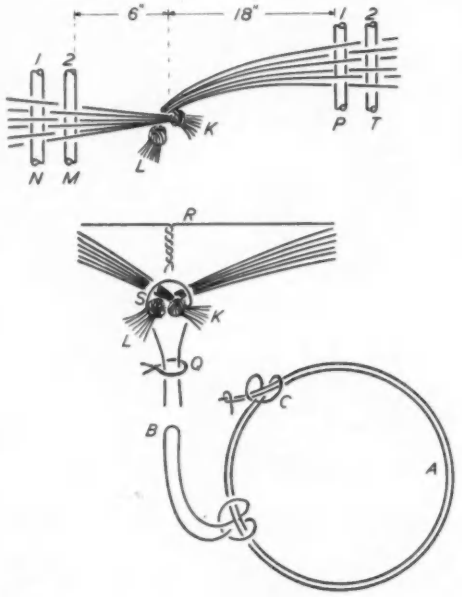


Fig. 1. Harness ends tied up ready for twisting in

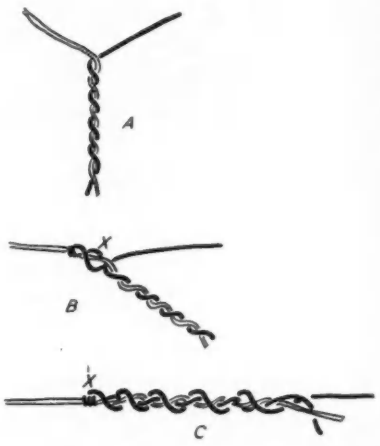
cord can be used to secure the lease rods N M P T, as shown. The weights also tension the warp beam.

The twister sits inside the loom, and if he is normally right-handed, a start is made at the right-hand side of the harness, because the actual twisting is done by the left hand. A band of cord A, Fig. 3, is tied round the twister's waist with a slip knot C, and a loop B, about 17 ins. long, is snitched round the loop, as shown. The waist cord slip knot C enables the cord to be tightened at the desired position, and also keeps the twisting loop B in position in relation to the



(left) Fig. 3. A—twister's waist band. B—twisting loop. C—slip knot. N and M—lease-rods at harness. P.T.—Lease rods at new warp. K—yarn knot from harness. L—yarn knot from new warp. S—enlarged view of loop B round knots KL. Q—nylon loop

(right) Fig. 4. A—initial twist. B—rolling twist. C—completed twist. X—hard point of twist



yarn knots. A suitable position for the knot C is just against the bottom left-hand waistcoat pocket. The first knot on the harness side is brushed straight, and a plain dog knot K, Fig. 3, is tied firmly about 6 in. from rod M. The first yarn knot of the new warp is similarly brushed straight and a dog knot L is tied about 19 ins. from rod P. The dog knots must be pulled very tightly or individual ends may slip in the twisting operation and cut the twister's fingers.

The twister's left hand is inserted inside the two sheets of yarn at the rod M, and this makes an opening through which the knot L is pulled by the left hand. When the latter is removed, the knot L should be sufficiently bulky to keep both knots in place, as shown at L and K. The twisting loop B is then passed over both knots, as shown at S, and the tails of the yarn knots are twisted round the loops to keep knots L and K in place. If there is a tendency for the knots to slip out of the loop, this can be remedied by tying a piece of thin linen or nylon cord Q round the loop; cord Q can be slipped up to the yarn knots to keep them in place. The knots are then ready for the actual twisting-in operation.

The first warp end on the harness side is selected on rods M N by the L.H. first finger which goes under and between the lease rods. At the same time, the R.H. first finger selects the first warp end from rods P T, the finger being on top of the yarn, as shown at Fig. 9. The L.H. first finger and thumb then slide down the harness end, and while the left thumb is kept under the harness end (when the knot is reached), the L.H. first finger catches the end from the warp, which is held apart from the other warp ends by an outward movement of the R.H. first finger; the two ends are then joined by a twist R, Fig.3, performed by the L.H. first finger and thumb. The two ends are broken off the knots L K by a sharp pull just at the beginning of the actual twist. The position of the L.H. fingers with the two ends ready to twist is shown at Fig. 10.

In cotton, wool, and rayon yarns the ends will break off clean and sharp if the knots L K are sufficiently tight and hard, but in strong smooth yarns like "Terylene" and nylon the ends may slip in the knot before breaking; if the yarn is too strong to break easily the slipping yarn may cut the twister's fingers. The actual stages of the twist are shown at Fig. 4. The two ends are

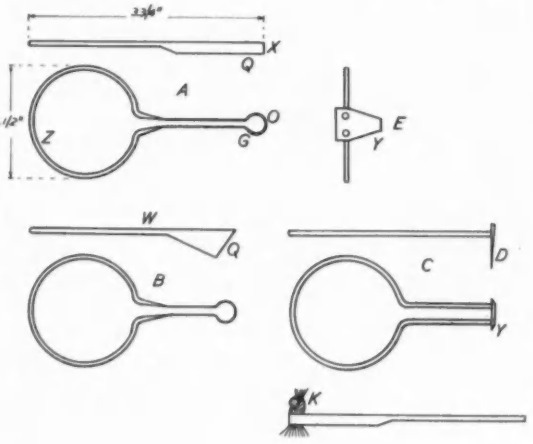


Fig. 5 (left) Cutters for twisting-in A—plan and side elevation of ordinary cutter. B—angled cutter. C—special cutter. E—front elevation. K—knot fixed in cutter

Fig. 6 (right) Steel cutter enlarged 1½ times

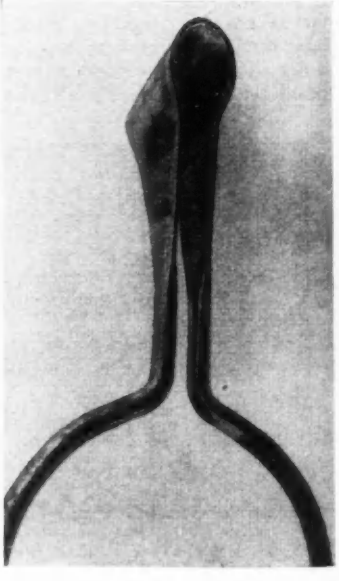


Fig. 7. Special Shears

twisted round each other, A, and then both the twisted ends are doubled and twisted over the single end B of the warp, to result in the completed twist C. The twisting over is done by rolling the L.H. thumb over the first finger in the direction of the healds. The short tails are left untwisted, as at C, but these do not interfere with the pulling through process. Thus the two ends are broken off and twisted between the L.H. first finger and thumb, and the doubled end is then rolled over by the L.H. thumb.

Some twisters make an extra long roll, while others give a reverse twist at the end of the roll in order to tuck in the tails' ends, but the speediest work is done with short rolls which are just sufficient to enable twists to be pulled through the healds and reed. When the first two ends have been twisted, the second pair are twisted, and so on until the end of the warp knots. The twisting fingers become polished with continual twisting, and the fingers are dipped in powdered whiting to ensure a grip when twisting. Whiting may cause rayon ends to filament, so a pad soaked with spindle oil is used to lubricate the L.H. first finger from time to time; the oil acts as an adhesive, nullifies static, and facilitates the pulling through process in wire healds.

Fig. 8. Hand hold for special shears

Cutters for Twisting-in

Many twisters use steel cutters instead of the cord loop B shown at Fig. 3, and the blade edges of the extremities of the cutters are sharpened to enable the warp ends to break easily and cleanly when the twister-in exerts pressure on the two ends to be twisted. Three types of steel cutters are illustrated at Fig. 5, and strips of $\frac{3}{32}$ in. dia. steel wire were used in each case. The cutter at A is an old type, the blade X of which was forged flat in the middle of the wire. The wire was then bent to the shape illustrated, and joined at Z. The yarn knots are positioned in the slotted portion and in the circular end portion O. Small knots K fit wholly into the latter, and larger knots of coarse yarn can be pushed up to O as twisting proceeds.

The function of the cutter is to facilitate twisting two ends together by cutting the required ends at Q when the twister begins the actual twist. The cutting edge is on the underside of the cutter and it is ground, as shown at G, so that the ends will be cut only if upward pressure is applied. Some twisters have the cutting blade at the top of the cutter, and exert downward pressure on the cutter. If a common knife edge is used, the yarn may be cut indiscriminately and the twister may cut his fingers. The top side of the blade must not be sharp in any way, or the hard knots of yarn which are pressing against the top of the blade will be cut, and slipping ends will be inevitable. Some twisters merely shape a piece of wire into the shape shown at A, Fig. 5, and do not have a cutting blade at all. The "cutter" does not cut the ends, but is useful for holding the twisting knots in position. This type may be used for the modified technique with special scissors explained later.

The new welding technique has made possible an improved type of cutter B, Fig. 5, which is made from a hoop of steel wire and a cutter made from high quality tempered sheet steel. The latter which is angled and welded to the wire at W, has the cutting edge either at the top or bottom. When the edge is at the bottom Q the angle of 60° further assists in cutting the required warp ends and allows freedom of movement for the upward thrust of the twisting fingers. A photograph of a cutter with the cutting edge at the top, is shown at Fig. 6.

Cutters may be made in various sizes for different yarn types. Cutter A, Fig. 5, is for fine and medium yarns, hence the long slot to accommodate bulky knots, while cutter B is of the short type used for fine yarns. Another type of cutter, C, has a small blade Y, shown in section at D and front view E, riveted to the steel wire hoop. The cutter is sharpened with knife blade edges, and the twister must press the warp ends against the blade pior to the rolling of the twist—i.e. one warp end is cut on the R.H. side of the blade, and the other end is cut on the L.H. side. This method is practicable for twisters who exert equal pressure on warp ends and harness ends simultaneously.

Good twisters-in prefer to have the choice of pulling on either the warp ends or the harness ends unequally, according to the strength and elasticity of the yarns. The tendency with this cutter is to cut the warp end first and then cut the harness end, and as this makes two cutting movements instead of one, speedy twisters dislike the type C; there is also an increased risk of finger injury on the blades. Male twisters-in prefer to use waist belts about 1 in. broad, and the cutters are attached to the belt by nylon cord.

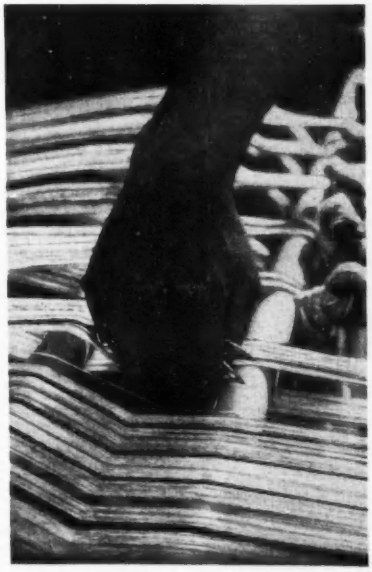


Fig. 9. Right hand selecting ends at warp lease-rods

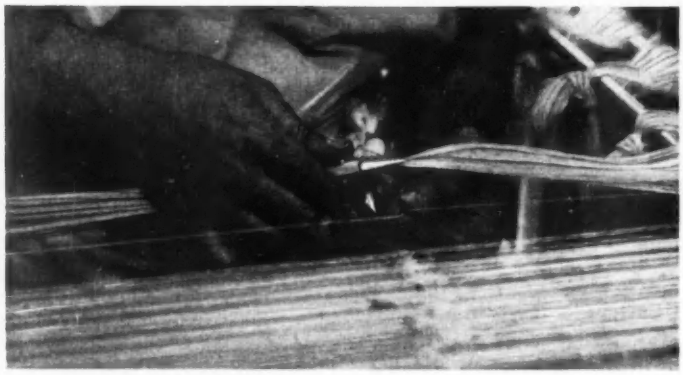


Fig. 10. Left hand ready to twist two warp ends, right hand cutting warp ends with shears

The above cutters are quite good for some types of strong yarns, but strong smooth nylon or "Terylene" warp ends require extra sharp cutter blades, and if the blades are sharp, the warp ends are cut prematurely by sideway movement of the cutter. In addition, the ends inside the knot of yarn do not contact the cutter blades, because the latter may be covered with tails from the previously-cut warp ends, and difficulty is experienced in breaking the ends before twisting. In many cases the difficulty in twisting-in strong warp yarns has proved insurmountable and the warps have been entered or knotted-in instead of twisted-in. The method detailed below is similar to the ordinary twisting-in methods, but the warp ends are cut immediately before twisting by using special shears or scissors. This method takes about 25% longer time than the ordinary twisting-in method with ordinary yarns which break quite easily, and the knots of yarn for twisting do not require to be ultra-hard.

Special Scissors or Cutters

The special shears shown at Fig. 7 have a spring which normally keeps the blades in the open position shown in the photograph. For the twisting-in operation detailed below the shears are held in the palm of the right hand with the little finger inserted in the hole, as shown at Fig. 8. When held in this position the shears do not interfere with the movements of the right hand as it selects the warp ends from the lease rods, nor as the right hand fingers push the selected end outward. The photograph at Fig. 9 shows the right hand pushing an end forward for twisting, and the points of the scissors are shown protruding from the palm, just above the front lease rod. When the right hand is brought to the yarn knots, as at Fig. 10, the weight of the shears makes them fall against the crook of the fingers, and the actual cutting is done by pressing the top blade downwards with the thumb until it contacts the lower blade pressed against the crook of the fingers. The actual cutting is illustrated at Fig. 10. Just as the L.H. finger and thumb join the end from the harness and the warp end ready to twist, the tails of both ends are cut as near the knots as possible by the scissors. The two ends are then free and are twisted together by the left hand. When this is done, the right hand moves again to the warp lease rods to select the next end from the warp. An abbreviated breakdown of the motions of both hands for the modified method is given below.

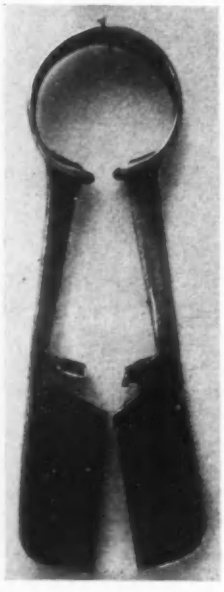


Fig. 11 (left) Cloth clippers that may be used for twisting

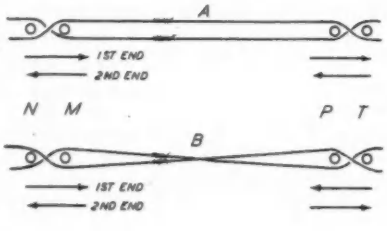


Fig. 12 (right) A—open lease. B—cross lease. N.M.P. and T—lease-rods (sectional view)

Synopsis of Breakdown of Motions for Twisting-in with Special Scissors or Shears

Set up as for normal twisting-in process.

Left Hand:	Right Hand:
Index finger selects end from (under) lease rods at healds.	First or second finger selects end from lease rods of warp (top).
Index finger pushes end forward between rods. Thumb presses on end outside of rods.	First or second finger pushes end forward to make a wide gap (Fig. 9).
Thumb slides down end from rods to yarn knots.	First finger between end and knot.
Both L.H. and R.H. ends are drawn together with thumb and first finger. Position as at Fig. 10.	Hand travels to knot and cuts both ends at knots. Position as at Fig. 10.
Roll both ends between thumb and first finger, i.e. twist.	
Twist over rolled ends and push forward.	Hand back to lease rods.
Hand back to lease rods.	
repeat	

If it is found that the sharp points of the scissors give trouble, the points may be rounded off on a grindstone. The cloth clippers shown at Fig. 11 may be used instead of the special shears. Nylon and "Terylene" yarns are very severe on the cutting scissors, and lubrication before the start of every warp is advisable. There is a knack in operating the cutters so that the blades press against each other and cut clean.

Open Lease Twisting

If both the L.H. and R.H. lease at the rods is similar, as shown at A, Fig. 12, the movement of the fingers to release the correct ends from the lease rods is in the same direction as shown by the arrows.

Cross Lease Twisting

Many twisters-in prefer the cross lease shown at B, Fig. 12, where the leases are different at the R.H. from the L.H., and the finger movement for end selection is in the opposite direction, as shown by the arrows. In pattern warps there may be no option as to which lease to use, if there are no spare ends, but cross lease is usually preferred. Warpers' flats will change a cross lease to an open lease unless the flats are thrown out.

Mesta and Roselle as Jute Substitutes

Investigations in better softening processes, either permanent or temporary during spinning may counteract the main disadvantage of these substitute fibres, i.e. stiffness

By Dr. S. B. BANDYOPADHYAY*

MESTA belongs to the botanical species, Hibiscus cannabinus, and is also known as bimlipatam jute, ambari or ambadi, kenaf, gambo hemp, Deccan hemp, etc., in different parts of the world. Roselle is known to the botanists as Hibiscus sabdariffa var. altissima. Mesta is grown in sufficient quantity in India, particularly in Deccan, in West Africa, U.S.S.R., Mexico, East Indies, South America, etc. A large quantity of roselle is also grown in India, but more in East Indies. Undivided India, having practically a monopoly in jute, did not pay much attention to the cultivation of these substitute fibres. Foreign countries, on the other hand, have within the last two or three decades developed scientific methods of cultivating these substitute fibres, kenaf in U.S.A. and roselle in East Indies under the Dutch regime.

Mesta does not require any special type of soil; well-drained, neutral, sandy-loam soil produces better fibre. It can be grown in plains as well as at altitudes of about 3,000 ft., only somewhat high land is necessary, for H. cannabinus cannot withstand waterlogging. For roselle the best soil is a heavy retentive, but friable loam, it should be neutral or slightly acidic. Roselle is much less sensitive to a water logged soil than Mesta. For both fibres close plantation—about 2 ins. apart in rows separated by 8 to 12 ins.—increases yield per acre as well as improves fibre quality.

Harvesting and Retting

Mesta is a photo-sensitive plant; sunlight helps the growth of the plant. Sowing should be so planned that the plants may have the benefit of the longer days of the year before flowering. For better type of fibres, mesta should be harvested just after flowering, and roselle should be harvested at the bud stage, that is, before flowering. Seed plants should always be separated from the fibre-yielding plants.

Mesta and roselle plants can be retted with much less water than that required for jute. Specially constructed baths with temperature and pH control and regulated slow water current are being used in some countries for retting kenaf. At 18° to 24°C. 10 to 14 days are required for retting. This time can be reduced even to 2 days if retting is done after ribboning (removing the woody portion mechanically) the plants. Chemical, bacterial or mechanical (by decortication) methods of retting are being investigated but none has yet proved to be successful from the point of view of cost and fibre quality.

Fibre Characteristics

The fibre coming out of each plant after retting is commonly known as reed or stem. The reeds of mesta, roselle and jute do not differ appreciably, in length and weight. A reed is generally 150 to 300 cm. long and 3-15 gm. in weight, in each case. The colour of mesta and roselle is in no way inferior to jute; for both mesta and roselle, colour varies from dull-yellow to white or dark-grey. The average along with the maximum and minimum values of some common physical characters are given in Table 1 for comparison.

The mass per unit length value or the coarseness of partially combed fibres (containing some remnants of meshy structure as well) is, in general, higher for mesta than for jute. The cross-sectional area of a single mesta fibre is also greater than that of jute fibre. This is likely to cause a greater bending resistance in mesta fibres and higher irregularity in mesta yarns.

The apparent density of fibres (including air spaces), which is a measure of lightness on hand, is the density of fibre just after immersion in mineral oil (a non-swelling medium). On an average, jute is denser than mesta, and mesta denser than roselle; while it is known that fibres lighter on hand usually give bad yarns. The true density (or the density of fibre substance) of roselle fibre is also less compared to that of jute.

The results of the mechanical properties[13], bulk torsional rigidity, ballistic work of rupture (B.W.R.), breaking twist and breaking strength are based on bundle tests on partially combed fibre. Bulk torsional rigidity depends on resistance to bending and torsion offered by the fibres and is measured on the principle of torsion pendulum. B.W.R. mainly measures the strength-extension product at the point of rupture under the optimum twist condition of the bundle. Breaking twist, as the name implies, is the twist per inch required to break a standard bundle kept under a constant load. Breaking strength has been expressed in terms of breaking length, which is the length of fibre-bundle of the same thickness the weight of which will be sufficient to break the bundle; the values are thus made practically independent of the variation in the size of the bundle. The results of Young's modulus, extension at break[12] and the fibre quality index[9] are based on measurements on single filaments. Since bast fibres have very low but nearly equal extensions at break, high value of Young's modulus is indicative of high stiffness; higher cross-sectional area may augment this effect and make the fibre still more resistant to bending.

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Table 1
Physical Characteristics of Mesta, Roselle and Jute

Characters	Mesta [5, 11] (5 Mesta + 5 Bimli) Av. (Range)	Roselle[12] (14 Samples) Av. (Range)	Jute [1, 11] (30 white + 3 Tossa) Av. (Range)
(1) Coarseness after standard combing—(microgm./cm.) ..	137 (83-230)	—	97 (66-240)
(2) Cross-sectional area[12] of single filaments (10^{-5} sq.cm.)	2·75 (1 sample)	—	1·82 (2 samples)
(3) Apparent Density (gm./c.c.) (after 3 mins. in mineral oil)	1·27 (1·23-1·33)	1·22 (1·15-1·30)	1·30 (1·19-1·35)
(4) (a) True Density (gm./c.c.) (after 90 mins. in mineral oil)	—	1·35 (1·28-1·42)	1·44 (4 samples)
(5) (b) True Density[12] (gm./c.c.) (in benzene)	1·46 (1 sample)	—	1·47 (2 samples)
(5) Bulk Rigidity (arb. unit) (0.2 gm./in. bundle, T.L.=10")	19 (17-21)	23 (19-27)	
(6) Ballistic Work of Rupture (in lb.) (0.2 gm./in. bundle, 0·7 t.p.i., T.L. = 3")	34 (18-40)	32 (27-40)	39 (25-60)
(7) Breaking Twist (t.p.i.) (0.04 gm. in. bundle, 1 kg. load)	4·1	—	4·2
(8) Bundle Strength[9] (km.) (T.L. = 3")	15 (12-21) (5 samples)	12 (9-15) (14 samples)	18 (15-19) (10 samples)
(9) Young's modulus[11] from fluxure of filaments — (10^{11} dynes/cm.^{2})	1·4-2·5 (2 samples)	2·3 (1 sample)	0·4-1·4 (2 samples)
(10) Extension[12] at break (%) (single filaments)	1·1 (1 sample)	—	1·1 (1 samples)
(11) Fibre Quality Index[6] (breaking twist of fil + gm./cm.)	30 (18-41) (10M + 6B samples)	—	57 (48-72) (15 samples)

The above results indicate that roselle fibre is the weakest of the three species under consideration, but offers the greatest resistance to bending, and hence is of the lowest quality; mesta fibre comes next.

The physical characters thus indicate that on an average mesta fibre may be classed with medium and low quality jute, and roselle fibre with low quality jute. But for most of the characters the range of values within mesta or roselle overlaps the range for jute (white and tossa), showing that a single sample of mesta or roselle may sometimes prove to be better in quality than an individual sample of jute. Only the ranges of F.Q.I. for mesta and jute do not overlap.

Microscopical

Photomicrographic studies of these fibres show that jute and mesta fibres have nearly similar longitudinal sections. The transverse sections, on the other hand, show that in jute the size of the lumen is generally big and more or less flattened, while in mesta the lumen is narrow, cell-wall being thick. This difference cannot, however, be regarded as a discriminating feature.

The ultimate fibres of all the three fibres, mesta, roselle and jute are polygonal in shape; their dimensions are given in Table 2. Greater stiffness of mesta and roselle compared to jute, is partly due to greater width of their ultimates and higher thickness of their cell-wall.

Chemical

Both mesta and roselle have chemical compositions very similar to jute.

Table 2
Dimensions of Ultimate Fibre

Dimension	Mesta* or Bimli	Roselle[6]	Jute*
Length (mm.) ..	3·3 (2-11)	1·8 (1·3-3·3)	2·5 (0·8-6)
Width (micron)	23 (13-34)	20 (10-32)	18 (5-25)

* J.T.I. (1941), 32, S.50.

Even the sugars which occur in traces in jute are also found in mesta. The Table 3 gives the average values of different chemical characters, for a large number of samples. Standard methods[3,4,10] have been used in their evaluation. Of these characters lignin content and acetyl value need special mention. The percentage of lignin is significantly higher in jute than in mesta or roselle; while the acetyl content is significantly higher in mesta than in jute. These characters may afford good criteria for distinguishing jute from mesta or roselle. The moisture adsorption characteristics of Hibiscus fibres are also not significantly different from those of jute fibre.

Technological Aspects

Standard Spinning Trials and Quality Ratio.—Mesta and roselle fibres from various sources were spun to 10 lbs. yarn by the same process and on the same rove-spinning frame with the same machine settings as used for standard spinning trials[18] for jute in the Technological Research Laboratory. Although greater moisture in fibre might be beneficial for stiffer fibres, like mesta and roselle, the usual 30% emulsion (composed of 20% mineral oil, 79·5% water and 0·5% emulsifier soap) treatment was followed in these trials.

The resulting 10 lbs. yarn was tested for grist and breaking load; the ratio of breaking load in lb. to grist in lb./spy and multiplied by 100, gave the quality ratio of 10 lbs. yarn—this is regarded as a measure of fibre quality. Irregularity of the yarns was also measured by weighing 2 ins. cut pieces and finding their co-efficient of variation (c.v.%).

The results of 23 mesta and bimli samples obtained from various com-

Table 3
Chemical Characteristics of Mesta, Roselle and Jute

	First Source[3] Average of 3 Bimli + 2 Mesta	First Source[3] Average of Jute	Second Source[4] Average of 5 Bimli + 5 Mesta	Second Source[4] Average for 60 Jute samples	Third Source[10] Values for one Sample each Mesta	Third Source[10] Values for one Sample each Roselle	Third Source[10] Values for one Sample each Jute
Ash	0·5	0·8	2·4	1·2	0·8	0·7	1·6
Wax	1·2	0·8	1·1	1·0	0·8	0·6	—
Nitrogen × 6¼ ..	—	—	1·6	1·3	2·4	1·3	1·5
Lignin ..	8·2	11·8	8·4	11·9	8·7	7·2	11·5
Holo-cellulose	—	—	87·0	83·3	88·2	90·0	88·2
α-cellulose ..	65·0	61·0	57·2	53·4	61·6	61·8	60·7
Xylan	12·8	11·9	15·8	13·3	15·6	16·3	14·7
Hexosem ..	8·6	9·2	9·2	11·1	6·5	7·8	8·1
Polyuronide ..	5·3	4·0	4·8	5·5	4·5	4·1	4·7

	Fourth Source[11] 10 Mesta Samples Av. (Range)	18 tossa + 18 white jute samples Av. (Range)
Acetyl content (milli-equiv.)	102 (93-110)	79 (68-90)

Table 4
Yarn test results of Commercial Varieties of Mesta and Bimli

	Mesta Samples	Grist	Quality Ratio	Wt. c.v. %
(1)	J.78 (1940)—I.J.M.A.	10·0	73	27
(2)	J.901 (1943)—Director of Industries, Bengal ..	11·4	85	27
(3)	" " " " " " ..	8·6	79	24
(4)	J.1265 (1945)—Messrs. K. M. Feil	10·5	75	26
(5)	J.1606 (1947)—Pussa I.P.3	9·9	81	29
(6)	J.1607 (1947)—Pussa I.P.6	9·9	82	28
(7)	J.1969 (1949)—I.J.M.A.R.I.	10·8	90	23
(8)	J.1970 (1949)—	10·0	83	24
(9)	J.1971 (1949)— "	10·1	72	23
(10)	J.2090 (1949)— "	10·4	73	26
(11)	SR.194	9·7	68	25
(12)	J.2333	10·4	67	25
(13)	J.2374	10·0	71	26
(14)	J.2384	9·5	62	26
(15)	J.2391	9·7	71	23
(16)	SR.239—Mesta Middle	9·8	60	27
(17)	SR.240—Mesta Bottom	9·6	45	41
	Bimli Samples	**Grist**	**Quality Ratio**	**Wt. c.v. %**
(1)	J.2334	9·8	63	26
(2)	J.2336	10·1	62	26
(3)	J.2385	8·7	55	26
(4)	J.2390	9·9	64	22
(5)	SR.236—Bimli Bottom	9·2	64	24
(6)	SR.238—Bimli Middle	10·1	50	30

Sources—References 1 and 22 and other unpublished work in this laboratory.

Table 5

Summary of Yarn test results of Mesta and Roselle samples of Agricultural Trials

Year of Trial	No. of Samples	Quality Ratio Av. (Range)	Wt.-c.v.% Av. (Range)
Mesta Samples—			
1949-1951	15	93 (69-103)	25 (22-30)
1952-1953	8	81 (72-90)	24 (22-27)
1953-1954	8	90 (71-99)	22 (20-26)
1954-1955	10	82 (61-92)	25 (22-29)
Roselle Samples—			
1950-1951	6	63 (59-67)	—
1951-1952	46	69 (51-90)	—
1952-1953	57	77 (61-88)	—
1953-1954	14	76 (58-90)	—
1954-1955	24	69 (59-78)	31 (27-37)

Source—Annual Reports of this laboratory.

mercial sources are given in Table 4. Table 5 gives the summary of the yarn test results of mesta and roselle fibre samples obtained from various agricultural trials done in different years. Variation of fibre quality from year to year may also be noticed. From a large number of spinning trials on jute it has been found that the full range of Q.R. of 10 lbs. yarns may be divided into four classes as in Table 6.

Table 6

Classification of Jute according to Quality Ratio

Class	Quality Ratio	Wt.-c.v. %
Best quality jute ..	100-130	16-26
Medium quality jute	80-100	20-29
Low quality jute ..	60- 80	24-36
Very bad quality jute	40- 60	32-48

Comparing the Tables 4 and 6 it is quite apparent that most of the commercial samples of mesta and bimli may be classed with the low quality (Q.R. 60-80) jute, only a few going outside the range. The agricultural samples (Table 5) on the other hand show that on an average mesta may be classed with medium quality (Q.R. 80-100) jute, and roselle with low quality (Q.R. 60-80) jute. Agricultural trials thus indicate that proper care in cultivation may well improve the quality of these fibres.

Spinning to Yarns of Different Grists.—Table 7 gives the results of some mesta and kenaf samples, both of same species spun to two or three different grist values. As obtained in the case of jute yarns, mesta yarns of higher grist have higher quality ratio and low weight—c.v.%. In most cases spinning performance deteriorates below 10 lbs. grist. Mesta, naturally roselle also, should not ordinarily be recommended for yarns finer than 10 lbs. In U.S.A., however, better modes of cultivation has produced Hibiscus fibre of better quality which can be satisfactorily spun to 8 lbs. Some of the high quality samples of mesta obtained in our agricultural trials also show possibility of their being spun to 8 lbs. yarn.

Table 7

Quality of Mesta Yarn Spun to Different Grists

Sample	Grist	Q.R.	Wt.-c.v. %
J.1606	9·9	81	29
	20·6	87	20
J.1607	9·9	82	28
	20·2	92	17
Over mature kenaf	11·3	44	—
	12·1	48	—
	17·3	52	—

Fibre Loss at the Card.—It has been observed that both mesta and roselle fibres are somewhat stiffer than jute fibres. This is likely to cause a greater loss of fibre during sudden tensions at the card pins. During standard spins records of the percentage of fibre droppings at the breaker and finisher cards were kept for a number of samples, some of which have been reported.[15] A summary of these records is given in Table 8. It shows that roselle fibres and also commercial mesta samples produce a card loss, nearly double the amount usually encountered for jute. Droppings for mesta samples obtained from agricultural trials were less, yet greater than the droppings for jute. This shows that mesta and roselle fibres require more softening than jute before they are fed at the carding machine.

Table 8

Fibre Loss at Carding Machines (Breaker + Finisher)

Nature of Sample	No. of Samples	% Droppings at breaker and finisher card Av. (Range)
Mesta—agricultural	4	3·7 (3·3-4·5)
Mesta—Daisee Bottom (Com.)	3	5·5 (4·7-5·9)
Roselle—agricultural	6	5·5 (4·6-6·7)
White jute—agricultural ..	8	2·5 (2·0-3·0)
Tossa jute—agricultural ..	5	3·3 (2·5-5·5)

Optimum Twist-Factor.—The optimum twist factors were obtained for seven mesta and two bimli fibre samples. The relations between the twist-factor (TF) and quality ratio (Q) values may be observed from the Table 9. These results show that similar to jute fibre—there is no sharp maximum. The optimum point lies between 11 and 13 in the several cases examined. On an average mesta fibres are likely to give the strongest 10 lbs. yarn if spun at a twist factor of 12.

Blending Scheme.—Mesta and roselle fibres being nearly similar to jute in many respects, they can be very suitably mixed with jute in a wide range of proportions, according to the type and the quality ratio of the required yarn. The Indian Central Jute Committee formed a committee[1] to consider these possibilities as early as 1949. They suggested the following scheme (Table 10) for the proportions of mesta that might be used in the mixture, according to the quality of the fibre and the type of hessian warp yarn required. Here it is assumed that mixtures of jat white and tossa jutes are used with mesta of average quality (Q.R.=70-90). Low quality mesta has not been considered here.

When using this table for yarns other than 10 lbs., small correction for the variation of Q.R. with grist should be applied. Thus, for the same fibre, Q.R. of 95 for 10 lbs. yarn is equivalent to about 90 for 8½ lbs. yarn. Owing to large variations in natural products this table may not give exact yarn quality ratio required—but no doubt it will be a very good guide for the solution of mixing problems and give approximate results.

Blending Trials.—The results of blending trials[15] with two low quality mesta samples are given in Table 11.

Table 9

Mesta and Bimli Spins (10 lbs. Yarn) at Different Twists

SR.194 (Mesta)			J.2333 (Mesta)			J.2384 (Mesta)			J.2391 (Mesta)			J.2374 (Mesta)		
G.	T.F.	Q.	G.	T.F.	Q.	G.	T.F.	Q.	G.	T.F.	Q.	G.	T.F.	Q.
10·1	9·5	53	10·1	9·5	63	9·7	9·3	57	9·9	9·4	69	10·2	9·6	67
9·5	9·6	63	10·1	9·9	66	9·1	9·4	64	9·8	9·8	64	9·6	9·7	67
9·8	10·0	66	10·3	10·3	68	9·3	9·8	62	9·6	9·9	73	9·7	10·0	73
9·5	11·1	69	10·1	11·4	67	9·2	10·9	63	9·7	11·2	74	9·9	11·3	72
9·5	11·7	66	9·7	11·8	68	9·5	11·7	67	9·3	11·6	67	9·9	12·6	65
9·7	12·5	65	10·1	12·7	67	9·5	12·3	64	10·1	12·7	70	10·0	14·2	61
9·8	13·2	66	10·4	13·6	71	9·9	13·3	62	9·8	13·2	67	—	—	—
9·8	14·1	64	10·2	14·4	68	9·7	14·0	60	9·6	13·9	68	—	—	—
9·8	15·0	62	10·1	15·3	62	9·9	15·1	55	9·7	14·9	64	—	—	—

SR.238 (Bimli)			Bimli + Jute (1 : 1)			SR.239 (Mesta Mid.)			SR.240 (Mesta Bot.)		
G.	T.F.	Q.	G.	T.R.	Q.	G.	T.F.	Q.	G.	T.F.	Q.
10·1	9·9	43	10·1	9·9	62	—	—	—	—	—	—
9·3	10·0	48	9·2	9·9	57	—	—	—	—	—	—
10·1	10·9	50	10·0	10·8	61	9·8	10.7	60	9·6	10·6	45
9·1	10·9	51	9·7	11·2	62	9·5	11·1	57	9·8	11·3	54
9·5	11·7	53	9·8	11·9	65	9·6	11·8	53	10·1	12·1	61
10·3	12·8	55	10·1	12·7	63	9·6	12·4	49	10·6	13·0	56
10·5	13·7	55	10·0	13·4	63	10·4	13·6	49	10·0	13·4	52
10·0	14·2	51	9·7	14·0	60	—	—	—	—	—	—

Table 10

Percentage of Mesta in Total Mixture[1]

Q.R. of Mesta in 10 lbs. yarn when spun alone	For low quality hessian warp				For average quality hessian warp				For best quality hessian warp	
	Q.R. of Jute in 10 lbs. yarn when spun alone				Q.R. of Jute in 10 lbs. yarn when spun alone				Q.R. of Jute when spun alone	
	90	95	100	105	95	100	105		100	105
70	5	25	35	45	Nil	15	25		Nil	10
75	5	30	45	55	Nil	15	30		Nil	10
80	10	40	55	65	5	20	35		5	15
85	20	60	75	80	10	25	45		10	15
90	80	85	90	95	15	40	60		15	20

Table 11

Results of Mesta-Jute Blending Trials,[1]

Proportions in the mixture			Total Card Droppings %	Yarn Grist (lb./spy)	Q.R. from yarn tests	Q.R. calculated from fibre quality
White Jute		Mesta				
Dhubri Bottom White Jute	+	Daisee Bottom Mesta				
100%	+	0%	3·3	9·8	95	—
0%	+	100%	5·7	9·7	64	—
60%	+	40%	4·7	9·9	72	83
70%	+	30%	3·8	9·7	86	86
80%	+	20%	3·6	9·9	85	89
85%	+	15%	3·8	10·0	89	90
90%	+	10%	3·5	9·8	92	92
Nowgong Bottom White Jute	+	Daisee Bottom Mesta				
100%	+	0%	4·0	9·9	87	—
0%	+	100%	5·9	10·5	70	—
10%	+	90%	5·2	11·0	76	72
30%	+	70%	4·6	10·3	76	75
50%	+	50%	4·0	10·6	79	79
70%	+	30%	4·3	10·6	78	82
90%	+	10%	3·7	10·7	78	85

The blended mixtures were spun to 10 lbs. yarn, and the total card dropping percentage and yarn quality ratio were recorded in each case. The values of Q.R. calculated according to the theory of proportional parts are also given in the last column; these values do not always agree well with the actual Q.R. found from yarn tests, but they no doubt give a fair estimate of Q.R. of the blend, except in a few cases. Disagreement is most probably due to the difference in the physical properties of the two blended fibres. Coarseness and stiffness of mesta being higher than those of jute, a thorough mixing in the feed may not have taken place.

Variations in Processing.—In the standard spinning trial[18] process the amounts of added oil and water are 6% and 24% of air-dry jute respectively. Experiments[16] were conducted in this laboratory on mesta fibre with about thirty variations in the composition of the emulsion. The results showed that the yarn quality did not deviate much from the best if the amounts of oil and water, as percentage of air-dry (at 65% R.H.) jute, were kept within the limits of 5 to 9% and 20 to 25% respectively. Beyond these limits yarn breakage at the spinning frame increased and the quality of the yarn deteriorated, but card droppings did not change appreciably. As shown in the case of jute[17], the binning for two days after application of the oil-water emulsion improved the yarn quality ratio of mesta fibres by about 3%.

Conclusions

Owing to the similarity of mesta and roselle with jute in respect of fibre characteristics as well as spinning performance, these two fibres have been regarded as the best substitutes for jute. On an average mesta may be considered to be equivalent to medium quality jute (Q.R. 80 to 100) and roselle to low quality jute (Q.R. 60 to 80).

A few dissimilarities are also present. While these substitutes have light colours, they are more coarse and stiff (particularly roselle). This causes greater fibre wastage (nearly double for roselle) in processing and makes spinning to finer counts (below 10 lbs.) very difficult. Differences in lignin content and acetyl content in the composition of the fibres help in distinguishing those fibres from jute.

Mesta and roselle may have some drawbacks in the spinning process due to their coarseness and stiffness, but they have a great advantage over jute in the agricultural field. Mesta and roselle can be cultivated with much less care and in varying conditions. But this has led to so much carelessness that local mesta and roselle are mostly unclean with mud and sand adhering to it. As early as 1919, the Special Committee[2] on jute and other fibres of the Imperial Institute, were also of the opinion that the Hibiscus cannabinus fibre could be used to a much greater extent in Dundee but agreed that its preparation was unsatisfactory. This was said mainly about the product produced by peasant cultivators.

Further studies in agricultural processes, particularly, in the spacing of plants, time of harvest and retting are likely to produce finer, stronger, and more pliable fibres. It is already known, that closer spacing in widely separated rows, harvesting at bud stage and retting plant ribbons (after breaking and removing the central woody portion) in controlled tanks have yielded very good fibres which may well compete with jute.

On the technological side, investigations in better softening processes either permanent or temporary during spinning may counteract the main demerit of these substitute fibres, namely, stiffness. Continued researches on the agricultural and technological aspects are sure to yield better results, and jute mills will not have to face fibre famine in future.

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Contemporary
Tapestries
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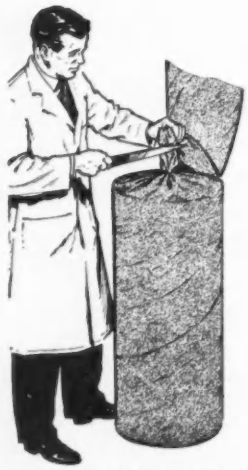

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Insulation Testing on Machines and Wiring

When dealing with a faulty section of installation the ceiling roses, lamp-holders, switches, fuse boxes, junction boxes and cords should be carefully examined as they may be responsible for low insulation resistance reading.

By "ENGINEER-IN-CHARGE"

FAILURE of insulation is a common cause of fire. This may result in arcing or in overheating of cables and other conductors due to the excessive current which then flows. Insulation failures may be either short circuits, or failure of insulation between conductors at different voltages; or earth faults, or failure of insulation between a conductor and earth or earthed metal casings or sheathings. Such failures may occur due to a conductor coming adrift from a terminal, mechanical damage, excessive heating of the insulation, insulation being affected by moisture or other substances, or the insulation being broken down by excessive voltage. In many cases developing defects in insulation occur gradually, and can be detected and repaired in time to avoid breakdown, if tested periodically by means of an insulation resistance testing set such as a "megger." Such tests are advised at intervals of six months or so.

Insulation Tests on Machines

The insulation resistance between the conductors and the earthed casing of a motor, including the cables between the motor and isolating switch and the starter, can be tested by opening the isolating switch, or removing the isolating fuses, and latching the starter closed. The test set is then applied between one of the starter terminals and the earthed casing of the starter. The test set should apply to the insulation a d.c. voltage not less than twice that normally applied to the motor when in use, except that the testing voltage need not exceed 500 volts for a medium voltage circuit (250–650 volts). Separate tests should also be applied to any secondary circuit, such as the rotor circuit of a slip-ring motor or the secondary circuit of a polyphase commutator motor. If one point of the rotor circuit of a slip-ring motor is intentionally earthed it may be necessary to open this connection before testing the rotor circuit, although in many cases the rotor circuit can be made "earth-free" by simply moving the rotor starter to the starting position.

In the case of a motor having a star-delta starter tests can also be made between each pair of phases by connecting the test set between the terminals A_0 and B_0, A_0 and C_0, and B_0 and C_0 in turn. It may, however, be necessary to interrupt the circuit through the under-voltage release coil of the starter which is usually connected between two phases of the starter. Tests between phases must be made with the starter in the "off" position. The under-voltage release coil circuit may be interrupted by separating overload trip contacts connected in this circuit, as at N in Fig. 1, pressing an electrical stop button switch, or disconnecting one lead of the under-voltage release coil.

When testing a polyphase commutator motor tests should also be made between the primary and secondary windings. Tests on a transformer should be made between the primary windings and case, between the secondary windings and case, and between primary and secondary windings; after isolating the transformer on the primary and secondary sides.

Impending failure of the insulation may be indicated by falling insulation resistance on successive tests over a period. However in general if the insulation resistance of a medium-voltage machine is below 0·5 megohm it is advisable that the various parts of the circuit be disconnected for separate tests on parts such as the starter, cables, brushgear, slip rings and individual phases of the motor windings. An unsteady reading on the test set often indicates dirt or other foreign matter on terminals, brushgear or other parts where the conductors are exposed; whilst a low test result on all parts of a motor usually indicates dampness. Once the part responsible for the low reading has been identified it is generally a fairly simple matter to ascertain the cause by careful inspection. Frequently the insulation can be restored to a satisfactory condition by cleaning or renewing a small piece of insulation, or drying out the machine.

Insulation Tests to Earth on Wiring

Periodical insulation resistance tests should also be made on the wiring in-

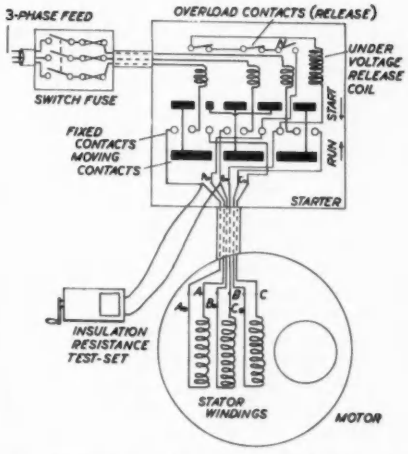


Fig. 1. Use of insulation resistance test set for measuring insulation resistance between phases on a star-delta motor circuit

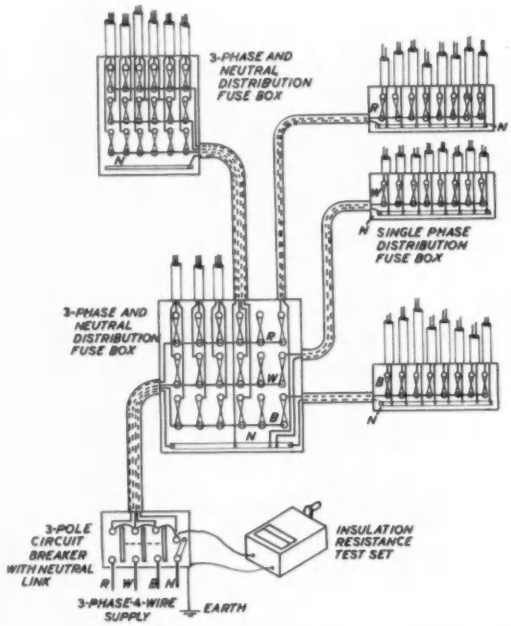

3-PHASE AND NEUTRAL DISTRIBUTION FUSE BOX
SINGLE PHASE DISTRIBUTION FUSE BOX
3-PHASE AND NEUTRAL DISTRIBUTION FUSE BOX
3-POLE CIRCUIT BREAKER WITH NEUTRAL LINK
INSULATION RESISTANCE TEST SET
3-PHASE-4-WIRE SUPPLY
EARTH

Fig. 2. Method of testing insulation resistance to earth on a 3-phase, 4-wire wiring installation

stallation itself in order that any weakness may be located and rectified before it results in a fire risk, and/or possibly electric shock. It may be necessary to test the installation in sections. Before testing care should be taken that all fuses are in position and intact, otherwise a faulty section may not be included in the tests. After isolating the installation or section from the supply, including the neutral, all the poles of the wiring should be connected together and to one terminal of the test set, as in Fig. 2, the other terminal of the set being connected to a reliable earthed point. In Fig. 2 the metallic conduits or cable sheathings act as the earth-continuity conductor which connects the various metallic casings together and to the earthed point.

In industrial premises it can be considered to be satisfactory if the insulation resistance of the complete installation is not less than one megohm. However a lower overall test result is likely to be obtained in an extensive installation unless the conditions are very good and the installation has been particularly well maintained. If the insulation resistance of the complete installation is less than one megohm any suspected section should be isolated and the sections tested separately. If a section is known or suspected to be at fault it is advisable to apply a reduced testing voltage in order to avoid the risk of breaking down the weak insulation. However in such circumstances the wiring should be overhauled so that a satisfactory test result is obtained when the full testing voltage is applied.

Where separate sections of a wiring installation are tested the insulation resistance to earth on each section should not be less than 50 megohms divided by the number of outlets, or $12\frac{1}{2}$ megohms divided by the number of outlets if the wiring is carried out with p.v.c.-insulated cables. Every switch and every point should be counted as an outlet, although a switch combined with a socket-outlet, appliance or lighting fitting is to be counted as one outlet. A "point" is any termination of the fixed wiring intended for the attachment of a lighting fitting or of a device for connecting to the supply a current-using appliance. Fig. 3 shows the minimum insulation resistance values which will satisfy the requirements for various sections of an installation, in accordance with "The Regulations for the Electrical Equipment of Buildings," issued by The Institution of Electrical Engineers.

Location of Faulty Wiring

If the test results on a sub-circuit give unsatisfactory values it may be necessary to disconnect parts of the wiring for further tests. The first step in so doing is to make separate tests on each pole, including the neutral pole, after making sure that no appliance or lamp is switched on so that it is connected between poles. If a low reading is obtained on the neutral pole with the lamp switches off the test on the neutral pole should be repeated after removing each lamp in turn on that sub-circuit. If the test result rises after removing a particular lamp the lead between that lampholder and its switch should be suspected, and should be tested separately. These leads are marked S in Figs. 4, 5 and 6. It should be noted that if the tests on each pole were made with lamp switches off and a lamp removed from its holder, or lamp burnt out, the lead between that lampholder and its switch would not be included in the tests.

If a low test persists on the neutral pole after removing all the lamps on that sub-circuit the neutral feed should be split at a convenient point and tests made on either side. The neutral feed may be split at a ceiling rose if wired as in Fig. 4, or 5, or the junction box if wired as in Fig. 6. If a low test result is obtained on the "live" (L) pole the live feed may be split for similar tests; this may be done at a lamp switch if wired as in Fig. 4, a ceiling rose if wired as in Fig. 5, or a junction box if wired as in Fig. 6.

The live and neutral sides of a ring circuit feeding socket-outlets can be independently tested after removing the circuit fuse and disconnecting the neutral conductors of the ring circuit from the neutral connector. If sections on the live side of a branch circuit fed from the ring need individual testing this can be done by disconnecting the branch cables at the socket-outlet or junction box, or removing the branch circuit fuse (if fitted). If individual sections of the live side of the ring circuit itself need testing the live side conductors must be separated at the fuse and at a junction box, socket-outlet or branch circuit fuse.

Individual tests of branch con-

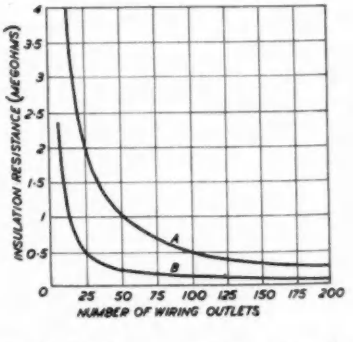


Fig. 3. Minimum satisfactory insulation resistance values for various circuits
A—Other cables
B—P.V.C. insulated cables

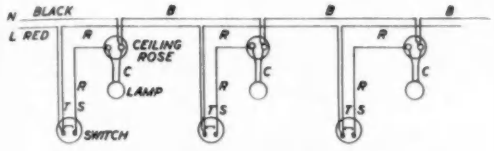


Fig. 4. Lighting circuit with two-terminal ceiling roses wired on the looping-in system

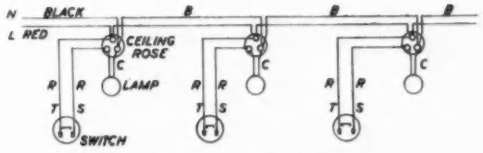


Fig. 5. Lighting circuit with three-terminal ceiling roses wired on the looping-in system

ductors on the neutral side may similarly be made after disconnecting the branch cable at a socket-outlet, junction box or connector. Tests on neutral sections of the ring circuit itself can be made after separating the neutral conductors at the neutral feed point, and at a socket-outlet, junction box or connector. Any section of an installation which has a low insulation resistance should be overhauled at the first opportunity.

Insulation Tests between Poles on Wiring

Tests should also be made between each pair of phases of a polyphase installation, and between each phase and neutral. For safe conditions the insulation resistance between poles should be no less than the values required for the test to earth, as in Fig. 3. Before making these tests it is necessary to make sure that no lamp or appliance forms a circuit between poles, or is liable to do so by the closing of a thermostat or other automatic device, as this would result in a zero reading being obtained.

In the case of a lighting circuit it is much the best plan to remove the lamps and switch on at the lamp switches before testing between poles, so that the test is applied also to the actual leads to the lampholders. If these tests are made with the lamps in position and the lamp switches off the test will include the insulation resistance between the leads to the lamp switches, which are marked S and T in Figs. 4, 5 and 6, but will not include the more essential tests between the leads C to the lampholders. Should the tests reveal low insulation resistance between poles on a sub-circuit the wiring may be split up for tests on individual sections at points such as the lamp switches if wired as in Fig. 4, the ceiling roses if wired as in Fig. 5, or the junction boxes if wired as in Fig. 6.

Insulation resistance tests to earth may also be made on small appliances, such as heaters, electromagnetic devices, etc. In general it can be considered to be satisfactory if the insulation resistance of each such appliance is at least 0·5 megohm.

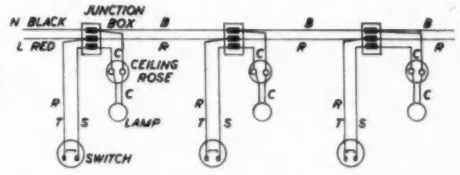


Fig. 6. Lighting circuit wired with twin cables and joint boxes

Overhaul of Defective Wiring

When dealing with a faulty section of a wiring installation or a faulty appliance the ceiling roses, lampholders, switches, fuse boxes, junction boxes and flexible cords should be carefully examined, as they may be responsible for low insulation resistance readings. Possible faults are dampness in switches, etc., displaced conductors at terminals tracking across insulation, dirt or other foreign matter, cracked, damaged or burnt insulation. If dampness is present in switches or fuse boxes it may be necessary to give them further protection after wiping out, or to drill a few drainage holes at the lowest point. If wiring in conduit is damp it may be possible to remedy this by removing the covers from conduit elbows and inspection boxes to ventilate the conduit and/or by cutting a few drainage holes at the lowest points of the conduit runs. Conduit should be spaced clear of any damp walls. Sometimes conduit can be dried out by pulling a piece of rag through. However where moisture has condensed in conduit in a concrete floor it is best to alter the run of the conduit to bring it clear of the floor, or to use lead-sheathed cable. P.v.c.-insulated cables are useful in damp positions.

Any displaced conductors should be firmly re-secured, any dirty insulation being cleaned. Insulation which has become damaged or burnt, or has allowed tracking to occur across its surface, should be renewed. Brittle insulation on cables may not be indicated by low insulation resistance values, but may fail due to vibration or mechanical shock. It is, therefore, a good plan to inspect parts of the wiring occasionally, especially in warm positions, after removing inspection box covers, etc. Mineral-insulated cables are advised for use in a position where the atmospheric temperature is very high. After attention to any faulty section insulation resistance tests should be made to ensure that all is in satisfactory order.

New Homogeneous Acid Milling Dyestuff

CARBOLAN Rubine 2B, a new addition to the I.C.I. range of acid milling dyestuffs, is of particular interest for the economic production of heavy shades on loose wool and slubbing, on which it gives very attractive bright bluish reds of excellent wet fastness properties and good light fastness, showing excellent build-up of shade. Very good exhaustion is obtained under the weakly acid conditions usual in these applications. The exhaustion remains excellent under neutral dyeing conditions, rendering Carbolan Rubine 2B of considerable value for application by the Carbolan Salt A process and for dyeing wool/cellulosic fibre unions. It is topical to note the new dyestuff's suitability for high-temperature (pressure) dyeing of wool.

On nylon and other polyamide fibres, Carbolan Rubine 2B yields attractive bluish red shades of good fastness to light and very good wet fastness, which can be even further improved, if required, by a simple "back-tanning" treatment. Carbolan Rubine 2B gives attractive bluish red shades of good light and wet fastness in the dyeing of natural silk.

In printing the new dye can be used for printing on wool and on silk, giving prints of very good light fastness and good wet fastness. Ground shades on these fibres and on nylon (on which fixation is, however, only moderate) are dischargeable to moderately good whites. Illustrative dyed patterns and full details of Carbolan Rubine 2B, which incidentally is in non-dusting form, are given in circular S.C.815 issued by I.C.I.

Mechanical Properties of Textile Materials

Four of the nine papers given at the recent conference held at Gothenburg, September 4 - 8, were presented by British authors; the rest were given by authors from U.S.A., Holland, Sweden and Australia. Abstracts from some of the papers appear on this and succeeding pages

The Dynamic Mechanical Properties of Wool at Very Low Frequencies

By F. L. WARBURTON

ATTENTION has been given in post-war years to the mechanical properties of high polymers, and a convenient method of investigating the behaviour of such materials over a wide range of mechanical conditions is to study the dynamic behaviour when the material is subjected to sinusoidal deformations of different frequencies. Many workers have derived relations connecting the behaviour under static conditions, i.e. creep and stress relaxation, and data obtained from dynamic experiments. In spite of this it is suggested that the data obtained from dynamic experiments at frequencies greater than 1 c/s are insufficient for predicting the behaviour in long-term creep, but much useful information might be obtained if the frequency range over which dynamic experiments are made were extended over several decades on the low-frequency side. The present paper reports the results of such measurements on wool over the frequency range 10^{-6} to 1 c/s at different temperatures and humidities.

Except when processes analogous to fibre slippage are involved, it is preferable to use the dimensions in some standard state to characterize the geometric parameters of the body under test. This method has several advantages:—

1. Whatever the state of the system, a given stress always corresponds to a given load on a particular fibre.
2. It avoids uncertainties such as correction for an unknown Poisson contraction or creep in length.
3. In thermodynamic analysis, these quantities are constants and not variables; their use, therefore, leads to much simpler thermodynamic relations.
4. When using models to characterize the behaviour of a material, swelling does not alter the total number of units either in the specimen as a whole or in the cross-section.

Experimental

The simplest method of investigating the dynamic elastic properties at low frequencies is to apply a sinusoidal extension to one end of the specimen and to measure the amplitude and phase of the force at the other end. One end of an English lustre wool fibre, 30 cm. long, is attached to a carriage which is given sinusoidal oscillations by means of a motor and gearbox. The plane mirror M_1, rotated by the movement of the carriage, deflects a light beam which records the position of the carriage, in a horizontal direction. The other end of the fibre is attached to a cantilever spring, the deflections of which are a measure of the load on the fibre. The deflections of the cantilever are recorded by a galvanometer mirror M_2, which deflects the light beam vertically. This mirror forms an image of a pinhole, placed in front of a galvanometer lamp, on the photographic plate P. As the carriage is moved to and fro, the spot records the movement of the carriage horizontally and force vertically, forming a loop on the plate. The apparatus is enclosed in a box, in which the temperature is thermostatically controlled, and constant humidity can be maintained. The galvanometer lamp G and the plate P are outside the box, which is provided with windows.

In operation, the fibre, which was specially selected as being free from medullation and uniform in diameter, was attached to the spring by Durofix and the spring screwed towards the carriage. The fibre was then held taut and clamped mechanically to the carriage.

When an experiment was first started, the movement of the carriage imposed a static strain equal to the

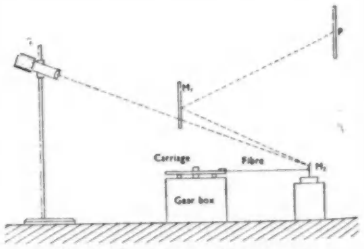


Fig. 1. Experimental apparatus

amplitude of the dynamic strain, but in order to allow for an initial decay in stress, an additional static strain was imposed by withdrawing the cantilever a short distance. At first, the decay in stress during a single cycle was too great to give a closed loop, but as the time constant for relaxation increased, sensibly closed loops were obtained.

Using a single fibre, experiments have already been made over a wide frequency range, under three different atmospheric conditions, namely:—

(*a*) 25°C. approx. 80% r.h. 18·8% regain.
(*b*) 25°C. approx. 70% r.h. 16·0% regain.
(*c*) 40°C. approx. 70% r.h. 15·6% regain.

By comparing the results for (*a*) and (*b*) the effect of moisture as a plasticizing agent can be investigated and, by comparing (*b*) and (*c*), the effect of temperature.

Conclusion

The results suggest that the effect of temperature on the dynamic mechanical properties of wool is mainly the result of a plasticizing action, as had previously been found for some other high polymers. The effect of absorbed moisture is more complicated in that it involves some modification of the elastic elements, although the reduction in internal friction is still the major effect. The effect on the elastic elements is itself complex in that different elements are altered in different ways.

The results also show, for the loads used, that all the creep and relaxation phenomena observed are visco-elastic and not plastic. Loading times of at least several months would be required before appreciable plastic (irrecoverable) creep became apparent, for after more than 15 months experimental work on the same fibre, it is still possible to recover the original length of the fibre, this despite the total extension having exceeded 7% on several occasions.

Textile Institute Conference

The Mechanics of Twisted Yarns: Tensile Properties of Continuous-Filament Yarns

By J. W. S. HEARLE, H. M. A. E. EL-BEHERY and V. M. THAKUR

ALMOST all continuous-filament yarns have some twist, and some are highly twisted, such as crepe and voile yarns, some yarns which are to be bulked, and many industrial yarns.

The simplest of the mechanical properties of a yarn to deal with is its behaviour under simple extension, and the paper is mainly devoted to an experimental study of the changes which occur in this behaviour as the twist in the yarn is altered.

Experimental

Materials Tested.—The experimental investigation has been carried out on viscose rayon, "Tenasco," acetate, nylon, and "Terylene" yarns. The yarns were tested as received, and after being twisted by various amounts.

The twist in each yarn was determined from 20 tests on a twist tester using 25-cm. lengths at a tension of 0·45 g. wt./tex., and the same specimens were weighed on a torsion balance in order to find the count of the yarn. The yarn diameter was measured by observation of the yarn with a microscope containing a scale in the eye-piece. Five observations were made on each of five 60-cm. lengths of the yarn held at a tension of 0·9 g. wt./tex. The surface twist angle was then calculated from these results, using the equation:—

$$\tan \alpha = \pi D t \qquad \ldots.(9)$$

where D = yarn diameter, cm.,
and t = turns/cm.

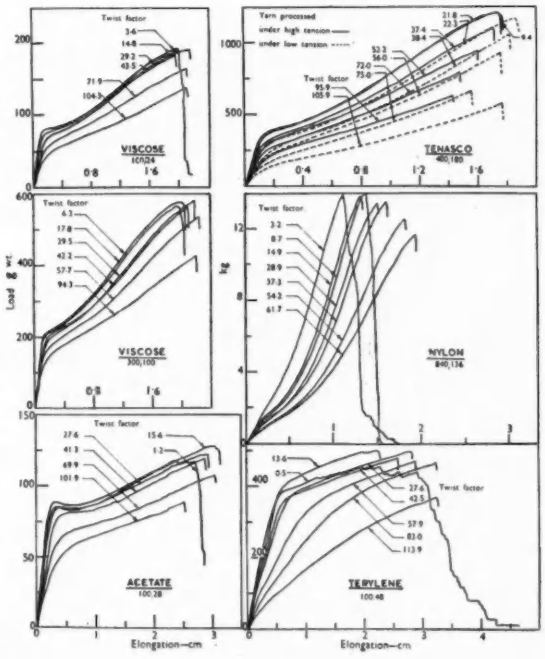


Fig. 1. Selected load-elongation curves of yarns

Tensile Test Methods

Three sets of tests were carried out, two of them on a table-model Instron constant-rate-of-elongation tester and one on an Uster constant-rate-of-

Table 1
Tensile Tests

Set	Instrument	Type of Test	No. of Tests	Spec. Length	Rate	Initial Tension
A	Instron	Initial part of load-extension curve	50	10 cm.	1 cm./min.	0·5 g. wt./tex.
B	Instron	Whole load-extension curve	10	10 cm.	4 cm./min. for viscose and "Tenasco" 10 cm./min. for acetate, nylon and "Terylene"	0·5 g. wt./tex.
C	Uster	Break	40	50 cm.	Time of break = 20 ± 2 sec.	1 g. wt./tex.

loading automatic yarn-strength tester. The essential details of these tests, all of which were carried out in a standard atmosphere of 65 ± 2% r.h. and 20 ± 2°C., are given in Table 1.

Results

Fig. 1 shows a set of load-elongation curves obtained for the materials.

Variability of the Results

The coefficients of variations of the yarn properties varied considerably from one yarn to another, from values as low as 1·6% to as high as 36%. Table 2 shows the values of the coefficients of variation, for each of the parameters considered, below which the majority of the results lie, together with the few exceptionally high values which occurred. In general, the coefficients of variation were greater for the higher twists, but the very low twist nylon and "Terylene" yarns also showed a high variability.

Discussion

Stress-Strain Curves.—The curves show qualitatively most of the features which are to be expected. The initial linear portions of the curves decrease in slope as twist increases, in a similar manner to theoretical curves, and the bends in the curves at the limit of proportionality become less sharp as twist increases, since the bend is spread over a range of yarn extensions with the centre filaments reaching the limiting extension first and the outer filaments later. Above the limit of proportionality, the slope again decreases as twist increases.

Effect of Twisting Conditions

Some of the results show differences in properties depending on the method of twisting and the tension in the yarn during the process. This is of inherent interest, but it is also a disturbing factor which must be borne in mind in considering how the properties vary with twist. One of the most marked differences is between ring-twisted and uptwisted viscose rayon. Another factor which may have some influence, is that the yarns twisted under the higher tensions usually have a smaller diameter.

Tensile Modulus.—While the absolute values of the tensile modulus show considerable differences, the relative values group fairly close together about a single line which falls away to lower values as the twist increases. The fact that, at high twists, most of the points lie below the theoretical curves indicates that other factors, neglected in the theory, cause the modulus to vary more rapidly with twist.

Limit of Proportionality.—The limit of proportionality of an ideal helical yarn should occur at the same value of strain irrespective of the twist, since the deviation from linearity begins when the centre filament, having the same extension as the yarn, reaches the limit of proportionality for the fibre. In fact there are considerable variations which must be explicable in terms of the same factors as the variations in breaking extension discussed in the next section.

Breaking Extension.—Because of the simplicity of the theoretical prediction (a constant breaking extension independent of twist) and the clarity of the experimental observations, a study of the values of breaking extension gives the most direct insight into the way in which the mechanics of real yarns differs from that of the ideal model. The present results confirm the observations of everyone except Platt that the breaking extension of most materials varies considerably with twist, but the picture is fairly complicated.

Tenacity.—In most of the results tenacity first rises as the twist increases and then falls. The initial rise is due to the effects of twist on a variable material, which result in the support of weak places in one filament by the neighbouring filaments, and the limitation of the initiation of breakage solely to the filaments at the centre of the yarn.

Table 2
Coefficients of Variation %

		Tensile Modulus	Limit of Proportionality (Stress)	Breaking Extension	Tenacity
Value below which most results lie		12	15	10	10
Exceptions					
Yarn	Twist Factor				
Viscose 75/75 ..	88·7	—	18·6	36·9	17·8
Viscose 100/24 ..	104·3	12·5	21·5	10·3	—
"Tenasco" 400/180 ..	95·9	—	15·5	—	—
"Tenasco" 1650/750 ..	64·5	—	19·6	—	—
Acetate 100/28 ..	69·9	—	—	10·8	—
	101·9	—	20·5	18·7	—
Acetate 100/48 ..	80·2	—	15·5	22·8	—
	101·2	—	16·9	20·9	—
	57·4	—	18·7	—	—
Acetate 300/78 L.T.	78·0	—	20·3	—	—
Nylon 100/34 ..	1·00	—	—	12·9	—
	16·80	—	—	12·9	—
	97·50	—	15·6	—	—
"Terylene" 100/48 ..	0·53	—	—	15·1	—
	57·90	—	—	11·9	—
	83·00	—	—	11·5	—

Conclusions

This experimental study of the tensile behaviour of continuous-filament yarns shows that theoretical predictions based on an idealised model of a yarn do give a reasonably adequate representation of the behaviour of real yarns, but there are also many other factors, and many complications in the story, which must be considered. Variations in yarn structure and fibre properties, slippage of filaments, processing methods and conditions, and instrument characteristics all play a part.

Mohair Development

A Scottish mohair manufacturer, Mr. Howard Nicholson (Cree Mills Ltd.), Newton Stewart, has invented a way to raise mohair yarn before it is knitted or woven. The result is a better distribution of the raised hair, and a finer finished garment. The yarn is pure mohair with no added agent, yet the end product is said to be much more satisfactory. The fibres are so strong, yet soft and the yarn is now on sale in limited quantities.

Characterisation of the High-Speed Impact Behaviour of Textile Yarns

By J. C. SMITH, F. L. McCRACKIN
and H. F. SCHIEFER

THE ability of a yarn to withstand a suddenly applied force or impact without breaking or deforming appreciably is usually characterized by the tenacity-strain curve for the yarn. Suppose, for instance, that the yarn must sustain a suddenly applied force. The yarn characteristics important in this case are the tenacity at break and the modulus or initial slope of the tenacity-strain curve. If the yarn must withstand large elongations, its rupture strain must be considered. Impact involves the yarn's ability to absorb kinetic energy from the impacter. The tenacity-strain behaviour of a textile yarn depends noticeably upon the rate of testing. Tenacity-strain curves obtained at the higher rates have steeper slopes, and the initial linearity of these curves tends to persist to higher values of tenacity.

A yarn attains its critical velocity at some value within the range 100 to 350 m./sec. This is the velocity at which the yarn ruptures immediately upon longitudinal impact and at the point of impact. In the region of high-speed impact velocities where wave effects become noticeable and eventually dominate, new measurement techniques are required, and new concepts become necessary to interpret the phenomena observed.

Illustrative Data

As an example of the way tenacity-strain properties of a yarn depend upon rate of straining, data for "Orlon" acrylic fibre are presented in Fig. 1. The curves having test rates of 1, 10, and 100%/min. were obtained with a commercial testing machine on 10 ins. samples at cross-head speeds of 0·1, 1, and 10 ins./min. The curve with test rate 5,000%/sec. was obtained by impacting 40 cm. clamped specimens transversely at the midpoint at impact velocity 41 m./sec. For these curves, it is seen that, as the rate of straining is increased, the tenacity at break increases, the elongation at break decreases, the slope of the curves at the origin increases, and the initial linearity of the slope persists to higher values of the tenacity.

Other data for the same "Orlon" fibre sample are presented in Table 1. Here it is seen that the breaking energy density, obtained by measuring the area under the tenacity-strain curve, tends to increase as the rate of straining is increased. It can be shown from the theory of transverse impact that the transverse velocity of 41 m./sec. used is equivalent to a longitudinal impact value of 6·5 m./sec., which is less than the 52 m./sec. velocity used in the longitudinal impact tests. Thus, it seems likely that the transverse impact value of breaking energy density is too high, or the longitudinal impact value too low, or both. If the breaking strain found by the transverse tests had been 0·5% less, the breaking energy density would have been less by 30 g.-cm./m.-tex, and would then be in good agreement with the other values given.

Measurement of Longitudinal Strain Wave Velocities

The velocity at which the transverse wave front propagates along a yarn is constant so long as the tension and strain in the wake of the plastic wave front are constant. If, however, the strain wave is reflected from a fixed end, back towards the oncoming transverse wave, the strain and tension at the transverse wave front will be increased when the two waves meet. The velocity of the transverse wave will then increase. This behaviour provides a method for measuring the strain wave propagation velocity.

A 3-m. length of the "Orlon" yarn was clamped at each end and impacted centrally at speed $V = 44{\cdot}6$ m./sec. Successive configurations of the yarn were recorded by a high-speed camera. Measurements showed that the transverse wave front propagated a distance of 12·2 cm. at constant velocity, and that the velocity then increased. During this time ($t = 0{\cdot}801 \times 10^{-3}$ sec.), the strain wave must have travelled a distance of 150 cm. up to the clamp and then back 137·8 cm. after reflection. Thus, the strain wave propagation velocity was $C = 287{\cdot}8/0{\cdot}801 \times 10^{-3} = 3{,}600$ m./sec.

At the impact velocity used in this experiment, the strain produced in the yarn specimen is only 0·2%. Consequently, the increase in length of the specimen due to passage of the strain wave may be neglected. Also, since the tenacity-strain curve is very linear in this region of low strains, the strain wave consists of an abrupt increase in strain at the wave front, and the wave front remains sharply defined as the wave travels along. Thus, the velocity of the transverse wave front increases abruptly when the transverse wave and the strain wave meet. The value of 3,600 m./sec. obtained in this experiment is higher than the 3,250 m./sec. calculated from the initial slope of the high-speed tenacity-strain curve in Fig. 1.

Tenacity-Strain Curves from Transverse Impact Tests

When a yarn specimen is clamped at each end and impacted transversely at the midpoint, reflections of the longitudinal strain wave and also of the transverse wave will occur at the

Table 1
Data for "Orlon" Acrylic Fibre

Method of Test	Modulus	Breaking Tenacity	Breaking Elongation	Breaking Energy Density		Limiting Breaking Velocity	Critical Velocity
	g./tex.	g./tex.	%	g.-cm./m.-tex	j./g.	m./sec.	m./sec.
Slow Speed—							
1%/min.	805	39·4	18·4	365	35·7	—	—
10%/min.	877	44·6	18·1	417	40·8	—	—
100%/min.	979	50·6	17·0	441	43·2	—	—
Transverse Impact—							
21 cm. half-length, 41 m./sec., 5,100%/sec.	1,080	60·6	14·6	474	46·5	305	276
Longitudinal Impact—							
52 m./sec.	—	—	—	432	42·3	291	—

The above data, and the curves of Fig. 1, were obtained from measurements on a continuous multifilament yarn of polyacrylonitrile designated as "Orlon" acrylic fibre, semi-dull, type 81, 150 denier, 80 filament, manufactured by E. I. du Pont de Nemours and Company.

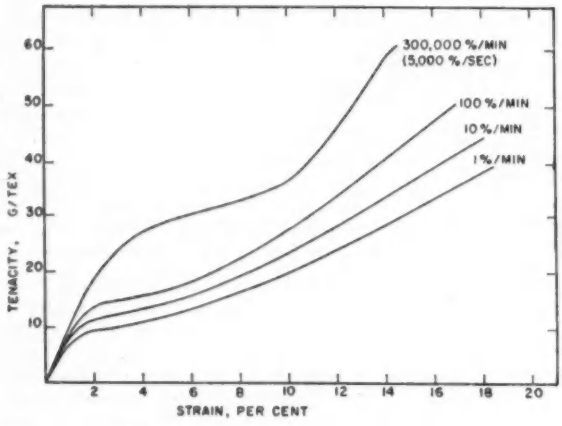


Fig. 1. Tenacity-strain curves for "Orlon" acrylic fibre at conventional and at a rapid rate of straining

clamps and at the impacting projectile. At these reflections, the local strain increases by finite increments which are small for suitably small impact velocities V. The average strain in the specimen then closely approximates the local strain. High-speed photography of the yarn segment's motion after high-speed impact provides data from which the tenacity-strain curve of the yarn can be computed. First, the average strain in the yarn as a function of time is determined from the increase in length of specimen divided by the original length, for each frame of the photographic record. Then, the velocity of the transverse wave front is determined from measurements of the position of the front in each frame of the record. The tenacity, which is equal to T/M multiplied by an appropriate conversion factor, is found from the wave front velocity and average strain. The tenacity-time and strain-time data are then combined to obtain the tenacity-strain curve.

There is yet another method for obtaining tenacity-strain data from high-speed impact tests. The yarn in this case is marked at regular intervals, impacted, and photographed with micro-flash equipment a short time after impact. From measurements on the photograph, it is then possible to determine the strain distribution along the yarn in the wake of the strain wave front. From this strain distribution, it is possible, using von Karman's theory in reverse, to obtain the tenacity-strain curve. It is also possible by experiments of this type to measure the strain wave propagation velocity. It should be pointed out, however, that the analysis of strain distribution data will always give a concave-downward tenacity-strain curve because of the initial assumptions upon which von Karman's theory depends.

Summary

The behaviour of a yarn after a low-speed tensional impact may be characterized by the tenacity-strain curve of the yarn material. A particularly useful parameter for this purpose is the breaking energy density or area under the tenacity-strain curve up to the breaking strain. At higher impact speeds, strain waves resulting from the impact become of appreciable magnitude and influence the way a yarn breaks. As a result, determination of a tenacity-strain curve by the usual method, of elongating a short yarn specimen and measuring the force at one end, becomes uncertain. Determination of a breaking energy density for the yarn material likewise becomes uncertain.

According to a theory by von Karman and others, a critical velocity exists at which a given material will break immediately upon tensional impact. In order to qualify, the material must have a concave-downward tenacity-strain curve, and be free from short-time stress-relaxation effects. Textile yarns satisfy these conditions approximately and therefore may be expected to have critical velocities ranging between 100 and 500 m./sec.

By observing the motion of transverse waves set up in a short clamped yarn segment, impacted transversely at the mid-point, it is possible to obtain a tenacity-strain curve for the material at a strain rate of 5,000%/sec. order of magnitude. Tenacity-strain curves at extremely high rates of stressing may be obtained from measurements of strain distribution in a yarn immediately after transverse impact, or from measurements of transverse wave propagation velocity as a function of the impact velocity.

Textile Institute Conference

Tensile Properties of Textile Fibres at Very High Rates of Extension

By G. HOLDEN

THE behaviour of fibres at very high rates of strain is a problem of great practical interest. In particular, the variations in the breaking stress and strain and in the form of the stress-strain curve, when compared with these properties at more normal rates of strain, are of considerable importance. Numerous measurements have been made on these variations at differing low rates of strain, but data at high rates of strain are rather more scanty.

Schiefer used a method whereby a specimen of nylon yarn, 65 cm. long, was clamped to two known masses. One of these masses was impacted, and details of the subsequent motion of both masses were obtained by high-speed cine-photography. The wave equations obtained could be solved to give the critical velocity of stress propagation.

Schiefer later fired a projectile at a specimen which was held transversely between two clamps. The resulting forms of the material were photographed, and the strains obtained by measurements on the photograph. The stress was then calculated by solution

of the wave equation obtained for transverse waves under these conditions.

Meredith accelerated one end of a fibre 13 cm. in length by attaching it to the outside of a rotating disc and measured the stress at the other end by a cantilever and optical lever. With this method, rates of strain of up to 1,100% per sec. could be produced.

Further work was carried out by Lewis using a method similar in principle to Meredith, but he achieved a much greater strain rate (23,000% per sec.) by shortening the specimen, applying a much larger acceleration, and keeping the mass of the moving parts low. The use of a relatively short specimen (7 cm.) also enabled this very high rate of strain to be achieved at a velocity considerably below the critical velocity for stress propagation. In the present paper, a modified version of Lewis's apparatus is described, in which the maximum rate of strain is increased to 66,000% per sec., and the accuracy improved by the reduction of extraneous vibrations.

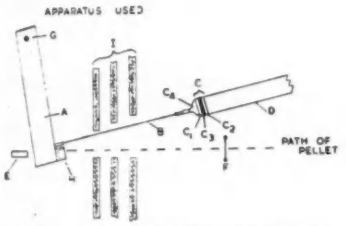


Fig. 1. Diagram of the apparatus used

Method

In the apparatus shown in Fig. 1, the high rates of strain required were produced by the impact of a pellet of 0·95 g. weight and 16,000 cm./sec. velocity fired from an air rifle on to a pivoted arm (A), 8 cm. long, which was free to swing about the axis (G).

The fibre specimens used (B) were 5 cm. in length, and the ends were formed by folding a piece of Sellotape, 1 cm. in width, over the fibre. This was then cut off so as to form a sheath. One end of the specimen was attached by Sellotape to the arm (A), while the other was attached to the crystal stress gauge (C), consisting of two X-cut quartz crystals (C_1, C_2) separated by a brass plate (C_3). The three were bonded together by Durofix and attached to the brass rod (D) and a piece of solid brass (C_4), to which the fibre was attached. The brass rod was about 10 m. in length and was suspended by long cords. This ensured that the first part of the stress pulse was not reflected from the end in time to interfere with the later part.

The charge produced on the brass plate C_3 was fed to an electrometer valve, which was cathode-coupled into a triode amplifier, and the output was fed to the Y_1 terminal of a Cossor Model 1049 Mark III twin-beam oscilloscope.

The strain in the fibre was measured from the velocity of the arm, which progressively obscured a beam of light (at right-angles to the plane of the paper) falling on the end of a Perspex light guide (E) leading to a vacuum photocell. The output from this was first amplified and then fed to the Y_2 terminal of the oscilloscope via a cathode follower. The two traces produced were recorded photographically and measurements were made from tracings of enlargements of the photographs.

The sweep of the oscilloscope beams was triggered by the pellet, which broke a piece of fine copper wire (F) before its impact on the arm. This wire was incorporated in the circuit shown in Fig. 2, and acted as the switch. When this was opened, a positive pulse was produced by the voltage divider R_1 R_2 and the large capacitor C_1. This pulse was then differentiated by C_2 R_3 so as to give a sharp peak, which was passed to the triggering circuit in the oscilloscope. The pulse also served to trigger a square-pulse generator, which was arranged to give a single 20-volt pulse of about 20 to 50 milliseconds duration. The output from this was fed to the intensity modulation on the oscilloscope, so that the beam was only at full intensity for about the same time as the duration of the sweep.

Considerable vibration was found to be induced in the crystal stress gauge by microphonic pick-up of the sound of the impact. This was reduced to negligible proportions by fitting three cork sheets I of about 5 mm. thickness between the arm and the crystal stress gauge. In addition, the gauge was surrounded by a metal shield (not shown) which also served to cut out stray 50 c.p.s. pick-up.

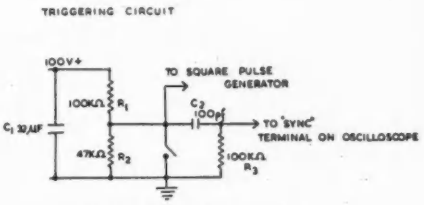
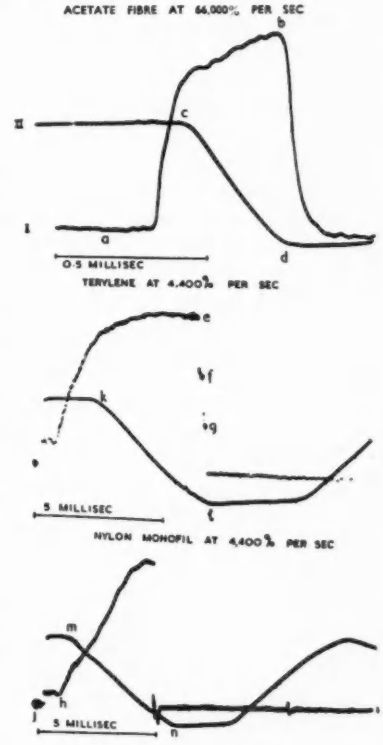


Fig. 2. Triggering circuit

Typical photographic records are given in Figs. 3a, b, c. They refer, respectively, to 34-filament cellulose acetate, 3-filament "Terylene" and nylon monofil at the rates of strain quoted.

Results

Results are presented below for the mean values of the breaking stresses and breaking strain. Interpolated values at a rate of strain of 1% per sec. are also given for later reference.



Figs. 3a, b, c (top to bottom)

Specimen	Nylon 10-fil. "Type 100"	Nylon "Type 300"	Nylon Undrawn	Nylon Monofil	"Terylene"	Cellulose Acetate
Mean breaking stress in g./Tex. at—						
0·033% per sec. ..	38	65*	4·9	45	36	9·8
3·3% per sec. ..	48	68	6·2	55	40	11·6
4,400% per sec. ..	49	84	10·3	59	39	14·4
66,000% per sec. ..	54	82	11·1	65	47	15·6
1% per sec.	45	66	5·8	52	39	11·1
Mean breaking strain in % at—						
0·033% per sec. ..	17·4	15*	16	20·4	19·5	33·7
3·3% per sec. ..	18·6	17·6	17·2	21·7	17·5	31·9
4,400% per sec. ..	14	16·6	25·8	16·9	19	26·6
66,000% per sec. ..	16	19·6	29·2	19·7	15	23·8
1% per sec.	18·3	16·2	16·9	21·4	18	32·4

* At 0·33% per sec.

Conclusions

The behaviour of medium-tenacity nylon at varying rates of strain is more complex than has hitherto been suspected, with losses in work of rupture of up to 20% and losses in the breaking strain of up to 25% (taking 1% per sec. as standard). No other materials tested showed decreased works of rupture. The work of other investigators was confirmed and extended in some respects but definite differences are shown in the breaking stresses for both high-tenacity nylon and medium-tenacity nylon, and in the breaking strain for cellulose acetate. The work shows that in the case of the nylon samples, the draw ratio has considerable, if not regular, effects on the properties at high rates of strain. Bearing in mind this final conclusion, work is now proceeding on "Terylene," cellulose acetate and viscose rayon samples of various draw ratios.

Textile Institute Conference

Mechanical Properties of Chemically Modified Cottons

By C. M. CONRAD

THE cotton fibre has many inherently valuable properties. The cellulose molecules of which it is composed are very long, and this valuable gift can be retained intact in many chemical modifications. Furthermore, these molecules are well aligned in the cotton fibre, a feat which can be realised in regenerated or synthetic fibres only by delicate and complicated drawing operations. Not only are the cellulose molecules in the cotton fibre well aligned, but the fibrils, the structural elements in which they lie, are arranged in a repeatedly reversing, spiral organisation, a mechanism giving to the fibre exceptional ability to extend, while still retaining strength equal to that of mild steel.

During recent years, the Southern Utilization Research and Development Division, Agricultural Research Service, U.S. Department of Agriculture, has been conducting extensive experiments to adapt cotton more adequately to new applications for which it is at present poorly, if at all, fitted. Cotton has been made highly flame- and rot-resistant. The ability to resist heat has been considerably improved, and highly elastic gauze has been produced to serve a valuable pharmaceutical need. Substantial improvements have been made in the crease-retention of ironed fabrics, and resistance to wrinkling has been greatly increased.

It is the purpose of the paper to discuss the effect of certain chemical modifications of cotton, performed at the Southern Regional Research Laboratory, on the mechanical properties of the products.

Cotton fibres, yarns and fabrics have been chemically modified by such heterogeneous reactions as acetylation, cyanoethylation, carboxymethylation, benzylation and reaction with β-propiolactone. The products studied, apart from the fibres, included principally low-twist, 2- and 3-ply relatively coarse yarns, 5-ply high-twist 12s sewing thread, approximately 48×48 sheeting and 80×80 print cloth.

Although not considered as a mechanical property, density is considered to affect mechanical properties and is discussed briefly. It is shown to decrease practically linearly with cellulose content of the modified cottons, except for carboxymethylation and benzylation, where variable mercerising concentrations of alkali were used in the preparation of the products. Equations are given for the linear relationships.

The breaking strength of cotton fibres, yarns and fabrics showed a variable response to chemical modification. Fibres more often than not lose strength. However, carboxymethylation at very low substitution considerably improved fibre strength. The strength of coarse, low-twist ply yarns, as well as of sheeting and print cloth, is usually increased, while that of high-twist yarns is usually reduced. Tearing strength of fabrics was reduced by all modifications tried, except carboxymethylation, which improved it materially. Cyanoethylation reduced the knot strength of sewing thread about 15%.

The ultimate elongation of fibres and yarns is usually decreased by chemical modification, especially when tension is applied in connection with the treatment. Carboxymethylation usually increased the elongation of fibres, but decreased that of yarns. Expect at low substitutions the ultimate elongation of fabrics was increased by chemical modification.

The tensile stiffness of fibres and of 2-ply yarns was generally increased by chemical modification. On the other hand, 3- and 5-ply yarns and fabrics almost invariably showed reduced tensile stiffness as a result of chemical modification. Flexural stiffness was greatly increased by cyanoethylation and carboxymethylation.

The toughness of cotton fibres was reduced considerably by chemical modification, except carboxymethylation and one or two cases of acetylation. Losses or gains of toughness of yarns depend on conditions of treatment and were variable. Fabrics usually gained considerably in toughness due, presumably, to shrinkage during treatment and the requirements of stress to restore the original dimensions.

The creep behaviour of acetylated sheeting increased with acetylation to high substitutions, but this could be improved relative to the control by heat and stretching. The permanent set of 7/2 mercerised yarn and print cloth was reduced by benzylation and cyanoethylation, respectively.

Elastic recovery of yarns was improved by benzylation or reaction with β-propiolactone. Cyanoethylation improved the elastic recovery of print cloth and the wrinkle-resistance of sheeting. The resilience of 7/2 mercerised yarn at strains of about 6% was improved by benzylation, but improvements were not observed at strains of 10%.

With the exception of carboxymethylation applied in aqueous media, which improved it, all chemical modifications tried have greatly reduced resistance to flex-abrasion. On the other hand, chemical modification has usually improved flat abrasion-resistance greatly. In one case, cyanoethylation improved the flat abrasion-resistance by over 75%.

TEXTILE MACHINERY and MILL EQUIPMENT NEWS

Induced Draught Cooling

Induced draught towers incorporating a recent development can be constructed with shells of reinforced concrete, asbestos, cement, tile, steel or timber

An important part of modern factory design is the provision of a means of water cooling which is efficient, economical to operate and which occupies the smallest possible space. A type of cooling plant which combines these requirements and which is becoming increasingly popular in this country is the mechanical cooling tower of the induced draught type.

In this type of structure the fans are situated at the top and cause the air to enter the base of the tower at a relatively slow speed and to leave from the top at high velocity. The advantages of this method are that the incoming air is circulated more evenly through the packing and that recirculation is not likely to occur. Recirculation is a difficulty which sometimes occurs with mechanical towers of the forced draught type, as in these structures the air is forced into the base of the tower at high velocity causing a depression into which the saturated vapour emerging relatively slowly from the top is sometimes drawn and recirculated through the tower, thus greatly lowering its cooling efficiency.

One of the leading British designers of this type of plant, Film Cooling Towers (1925) Ltd., has developed a system of packing for induced draught cooling towers which is said to provide the greatest possible degree of heat transference with a low capital outlay. This system, known as "Film Flow," distributes the liquid evenly over the packed area of the tower and gives the cooling air unimpeded access to all parts of the packing.

The water is led to the tower either in a closed pipe or in an open culvert from which it is discharged into secondary troughs through orifices specially designed to prevent splashing. From the secondary troughs it is fed into weir type spreader troughs running the entire length or breadth of the tower at a pitch of 6 ins. The spreader troughs, which have specially shaped notches at 2 or 4 ins. intervals, rest on the top layer of the tower filling. The filling is composed of a number of horizontal trays of parallel laths, the direction of each layer of laths being at right angles to the trays above and below it. The effect in plan view is of a grid composed of 2 ins. square network and the water upon being discharged through the trough walls flows down the grid packing in an even film changing direction through 90° in every 2 ins. down the whole depth of the stack.

This method of distribution ensures that the entire surface of the packing is evenly wetted, providing a very high heat exchange co-efficient, which together with the fact that the cooling air has a relatively unimpeded flow throughout, effects an economy in the cost of the power to drive the fans. Also, by completely avoiding the formation of water drops, there is a smaller loss of water by entrainment and the use of baffle plates and drift eliminators is unnecessary.

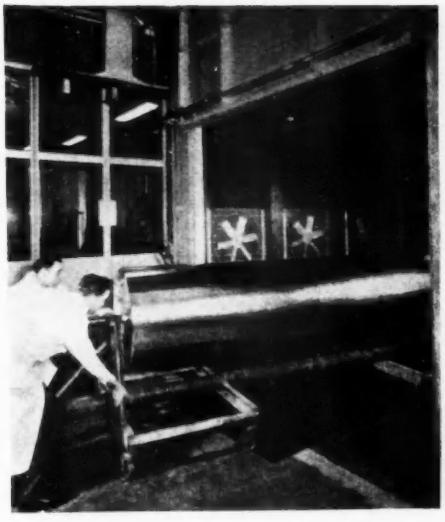
The salient feature of the "Film Flow" system, however, is the saving in space, as the packing depth can be reduced in some cases by as much as 50% of the space required by the normal drip bar packing system. This is reflected in both lower capital costs and in considerable saving of the power required to obtain the pumping head.

Induced draught towers incorporating the "Film Flow" packing system can be constructed with shells of reinforced concrete, asbestos cement tile, steel or timber according to clients' requirements and local conditions. The system is entirely of British design and further details may be obtained from the manufacturers at Kew Bridge, Brentford, Middlesex.

P.T.F.E. Dispersion Coating for Rollers, Hoppers, etc.

CONSIDERABLE interest was aroused by the announcement some month's ago of the availability of polytetrafluoroethylene dispersion coating facilities at the Tottenham factory of Siemens Edison Swan Ltd. This coating can be applied to articles of almost any size. New applications for this process are being discovered daily and at present include the surfacing of rollers, moulds, hoppers, etc., used in the textile, papermaking, and chemical industries, etc., whilst the company has been called upon recently to coat the inside surface of xanthating churns, used in textile manufacture.

Polytetrafluoroethylene (or P.T.F.E.) has, in addition to excellent electrical characteristics, and heat and corrosion resistance, properties which are such that dispersion coating of articles results in a completely inert and non-stick surface with an almost zero co-efficient of friction. The thickness of the coating varies according to the needs of the article being coated, i.e. resistance to abrasion, etc., but usually range from about ·0005 to ·004 in. Coatings of this order stand up to wear remarkably well and although P.T.F.E. is still comparatively expensive, the thin deposit which is usually adequate for most purposes renders treatment of quite large articles a very economical proposition.

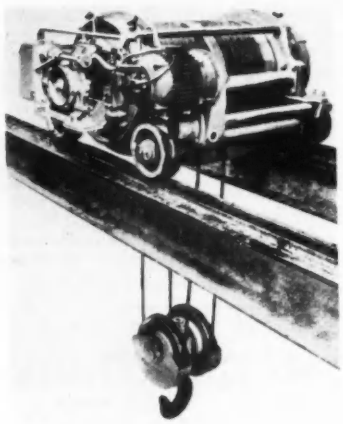


A large textile roller being wheeled into one of the sintering ovens

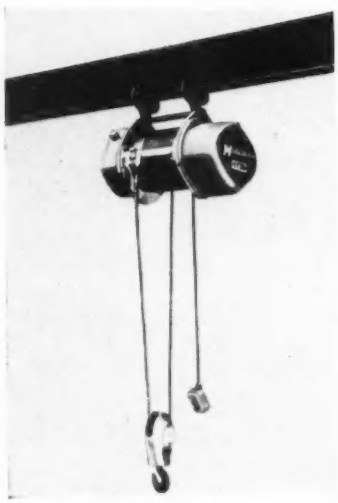
Electric Lifting Equipment

THE new 101 electric hoist block, recently announced by Matterson Ltd., Healey Works, Rochdale, is arranged to lift up to 1 ton, through 23 ft. at 20 ft. min. The hoist is equipped with positive rope guide operated shunt and series over-winding and over-lowering limit switches, and control is by "hold-on" type pendant push buttons. The alloy steel gears are all mounted on ball or roller bearings, running in a totally enclosed oil bath gearcase. The barrel is supported on the full diameter in grease lubricated roller tracks in all steel frames. The hoist is supplied in the usual fixed suspension and pedestal mounting forms—push, hand chain, and power travelling suspension trollies. In patent low headroom construction the hoist occupies only 13 in. of headroom. All trollies are adjustable for varying beam widths up to 6 ins. wide.

A recent addition to the Matterson range of electric travelling crabs for overhead travelling cranes, the 701, is designed to lift loads up to 10 tons through 33 ft. 6 ins. It conforms to the company's conventional design being of all steel monobloc construction requiring minimum headroom, and giving close hook approaches. Oil toughened alloy steel gears are employed throughout, running on ball bearings in totally enclosed oil-tight gearcases. The crab is mounted on two axles, one of which is of patent compensating type to ensure even distribution of load on all four runners. The driving runners are driven through totally enclosed spur reduction gearbox and friction clutch to give gradual acceleration and overload protection.



Matterson size 701 crab, 10 tons capacity



Matterson 101 electric hoist block

New Digital Display Unit

A FEATURE of a new in-line digital display unit manufactured by Counting Instruments Ltd., 5 Elstree Way, Boreham Wood, Herts, is that each unit comprises a system of lenses whereby a figure or letter is projected on a screen by means of twelve lamps. The main advantage claimed for this is that the image always appears in the same plain, giving a very wide angle of view. The units can be banked together to give, e.g. the read-out on a digital volt meter, though numerous other applications exist. The large illuminated figure 1 in. × $\frac{5}{8}$ in. gives high contrast for excellent visibility. The standard model has provision for projecting the figures 0 - 9 and two decimal points. A number of other models are being developed showing letters, signs, and provision for either coloured characters against a black background or a coloured outline to a white character. Standard models are available for 6, 12 and 24 volts.

Floor Surfacing Compound

The importance of maintaining concrete flooring in factories, warehouses, yards etc., in a really hard condition cannot be too strongly emphasised. This is particularly the case where handling equipment having steel wheels is in use and also where products are being handled which are susceptible to the effects of dust. A new concrete hardening material is now available which produces a surface which is non-slip and practically unwearable even with the heaviest industrial use. Produced by J. H. Sankey and Son Ltd., the well-known building material specialists, and known as "Emerytop," it is applied when the concrete is being laid, which means a considerable saving in time. The fact that a screed is not required also effects a certain amount of economy.

After the concrete has been consolidated, trued to level and the surface closed with a steel trowel, "Emerytop" is sprinkled at the rate of 4½ lbs./sq. yd. A steel float is then used to bring the moisture up through the material. Immediately after, a further application is made also at the rate of 4½ lbs./sq. yd. and the moisture is again brought up by means of the steel float. This surface is then smoothed off with a trowel. A final trowelling is given in order to obtain a hard and dense finish.

An important advantage which is gained from the use of this floor surfacing compound is that as it will only produce a smooth finely graded even finish on a low water ratio mix of the type which results in good quality concrete, the architect or engineer in charge can verify whether his instructions in respect of the concrete mix have been adhered to. If the material should be laid on a wet, sloppy mix of the type that results in weak friable concrete, the rough uneven finish which the "Emerytop" will assume will betray this fact.

The compound is available in various colours. If an oil resistant floor should additionally be required this can be obtained by the subsequent application of "Sealtop" produced by the same manufacturers. With several applications of this latter finish the floor can be given a hard glassy surface $\frac{1}{8}$ in. thick which is impervious to all except the most active oils and greases. Further details are available from the manufacturers at Ripple Road, Barking, Essex.

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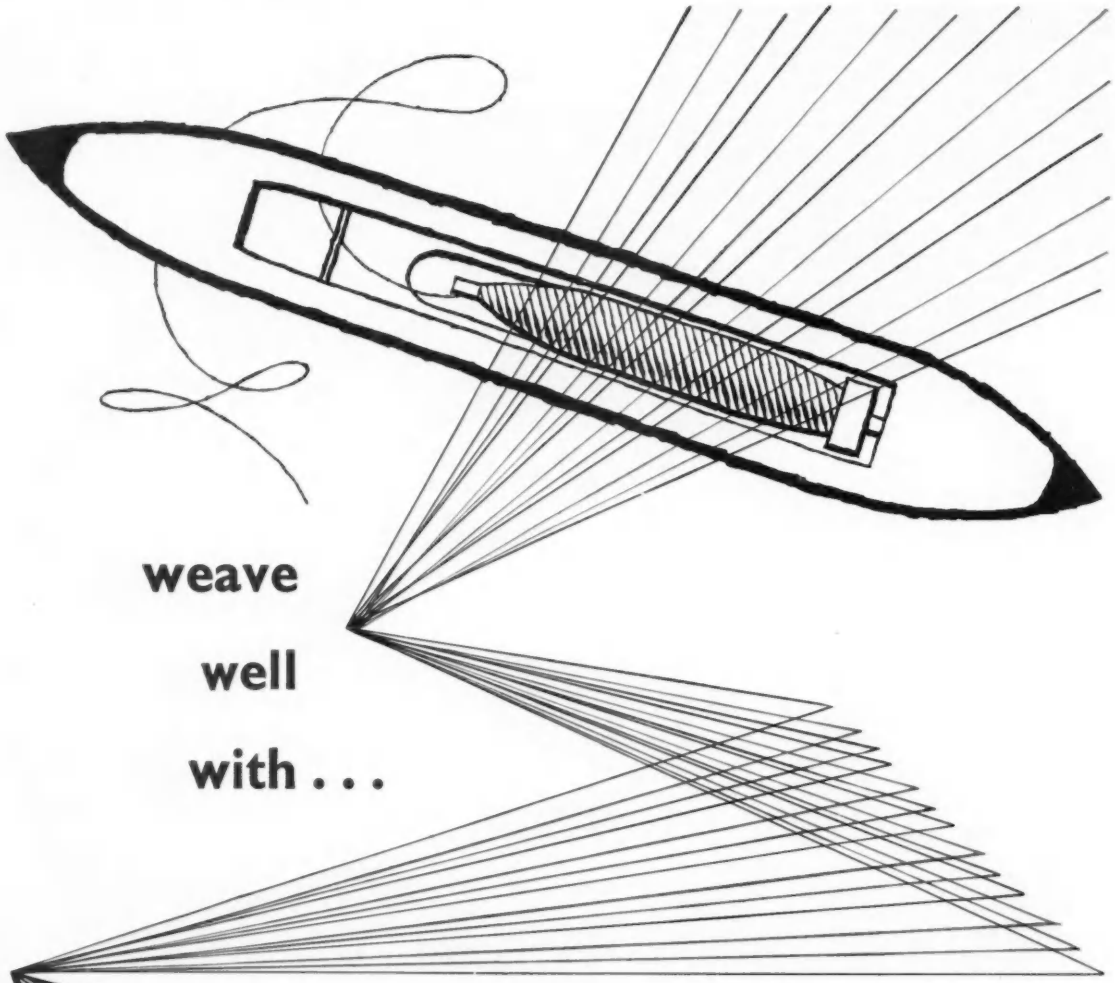

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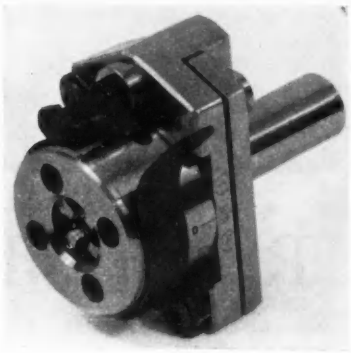
IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1.

The "XT" Self-Opening Diehead

THIS new-type Coventry diehead has been specially designed for use on single-spindle automatics such as the Brown and Sharpe No. 00G, B.S.A. No. 48 and C.V.A. No. 8 machines. Besides other notable features, the Style "XT" diehead is also equipped with external tripping mechanism. This eliminates the possibility of the diehead's opening due to centrifugal force produced by the very rapid indexing of the turret on these high-speed machines.

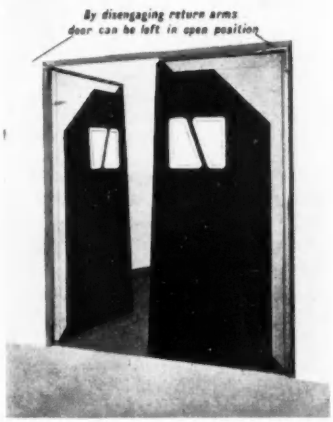
A particular advantage is its ability to cut short threads; the diehead can be set to trip almost immediately the dies commence cutting. The diehead is fitted with a spring-cushioned shank which provides lateral movement in both directions to compensate for the slight difference which may exist between the pitch of the thread and the forward motion provided by the feed cam. This cushion-action ensures a good start to the thread and also, with the substantial sliding dogs, provides an easy sliding movement ensuring long die life. The spring pressure can be varied.

The Coventry $\frac{1}{4}$ in. Style "XT" diehead will cut threads from 12 B.A. to $\frac{1}{4}$ in. Whitworth with appropriate dies, and as the shank is hollow, screws of any length can be cut. The diehead uses the same dies as fitted to all $\frac{1}{4}$ in. size Coventry dieheads which enables the standard die grinding fixture and height gauge to be used for regrinding. "XT" dieheads can be used on small capstan and centre lathes.



New type Coventry diehead designed for use on single speed automatics

Flexible Doors—Increase Transport Efficiencies



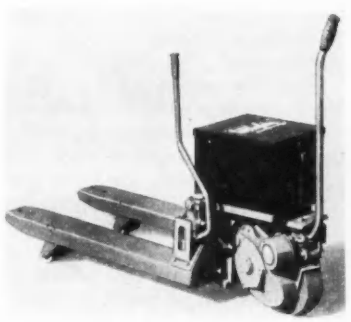
THE illustration shows the most recent design in flexible rubber doors—made by Superbuilt Products Ltd., Bell Works, Harefield, Middlesex. Many improvements have been made including fitting of the company's patented hinges which, as will be observed, are mounted at the top of the doors, a factor that reduces possible damage to a minimum. In this latest construction, the framework is bright mild steel and there are only two hinge units to each pair of doors. Only four bolts need to be undone in order to remove each hinge unit for servicing.

By disengaging the retaining arms, the doors can be left in open position without any danger of over-tensioning the springs. The spring acts in compression and, therefore, likewise cannot be over-tensioned. There is provision for adjustment by means of a $\frac{3}{8}$ in. Whitworth nut. All working parts are case-hardened and a $\frac{5}{8}$ in. dia. ball is fitted to the bottom of each door to act as a pivot bearing; this reduces friction to an absolute minimum. Designed to fit in with all modernisation schemes and new lay-outs these doors are valuable factors in helping to assist production and transport of materials, etc.

Electric Battery Pallet Truck

OFFERED in a variety of small chassis and body designs suitable for 10 cwt. loading, the E412P electric battery pallet truck announced by Wessex Industries (Poole) Ltd., West Street, Poole, is an ingeniously designed, compact unit for use in confined spaces, upper floors, gangways, lifts, etc. Easily handled with manual or power operated hydraulic pump and ram, the power unit is completely enclosed in one small fabricated housing which carries the motor with automatic brake on the armature, reduction gearing, controller, three-stud ball bearing wheel hub, taper roller bearing steering head, driving a detachable 10 × 3 bonded solid rubber tyred wheel.

The pallet forks are available in alternative lengths and widths to suit British Standard or special pallets. Powered by an Exide traction 12 volt, 87 amp. hour battery in quickly detachable steel case with charging socket, the truck is complete with a Westinghouse charger. The makers state that the power unit, with controls and drive, can be supplied separately if required in such form.



Wessex electric battery pallet truck

THE TEXTILE
COLOURIST & FINISHER

Reactive Dyes for Cellulose Fibre Goods

Some significant features of recent dyestuff discoveries

By B. C. M. DORSET

THE recent introduction to dyers by British and Swiss dye manufacturers of Procion and Cibacron dyes applicable in large scale dyeing to cotton, rayon, and cellulose fibres denotes the success of many research workers who have endeavoured over at least a half century to discover reliable methods for dyeing textile goods so that the dyes applied become chemically united to the fibres. The incentive behind this quest is the belief that if the dye component of the fibre-dye complex is of suitable composition then the fastness to washing of the dyed material will be much greater than that of comparable dyeings in which the dye is simply deposited in and between the fibre molecules without any chemical union with these. Such chemical combination of dye with fibre cannot, of course, ensure in the same way that the colouring will have high fastness to light and other adverse influences.

In seeking to combine dyes with fibres two main possibilities can be envisaged. In one, the dye can be of such a nature that it contains a reactive atom or group of atoms capable of reacting directly with the fibre substance so as to chemically unite with it. In the other, the fibre may first be treated to give it a reactive atom or groups of atoms capable of reacting with the dye. It is the first possibility which is likely to be most satisfactory since, in modifying the fibre substance to make it reactive towards dyes, the fibre properties may be permanently affected and not always with advantage.

A certain degree of success was obtained in early researches which dealt with conferring on cellulose fibres a reactive group of atoms, particularly the amino (NH_2) group. When this group is indirectly linked to a cellulose molecule by a benzene or naphthalene ring structure it is capable of diazotisation to give a diazo compound which in its turn has the power to couple with aromatic naphthols and other similar compounds thus giving coloured products of which the cellulose obviously forms a part. Thus cellulose combined with para-nitrobenzyl chloride (B.P. 344,420) and the nitro group then reduced to an amino group can be permanently coloured in this way and as indicated in Fig. 1.

Perhaps more significant, having regard to the reactive dyes recently discovered, is a process described in B.P. 342,167 by which cellulose fibres are treated with cyanuric chloride (this contains three reactive chlorine atoms) so that chemical combination takes place between not more than two of the chlorine atoms and the fibre to give a product having at least one

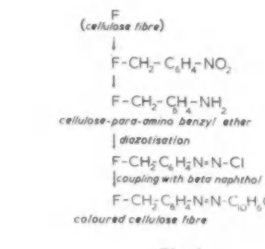


Fig. 1

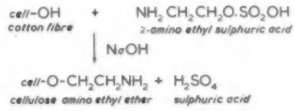


Fig. 2

reactive chlorine atom so that this can be further reacted with a dye intermediate having amino groups. Thus are produced fibres chemically combined with an aromatic residue having an attached amino group which can subsequently be diazotised and coupled with a naphthol to give a fibre chemically combined with a dye.

On the whole these earlier methods for producing dyed cellulose fibre materials in which the fibres are chemically combined with coloured compounds (dyes) are too roundabout and complex to be commercially useful and it has thus come about that more recent research has been directed towards devising more simple procedures for causing dyes to combine directly with the cellulose fibres. Very interesting progress was made by Guthrie some ten years ago (J. Text. Research, 1947, **17**, 625) arising out of investigations for introducing amino groups into cotton by use of 2-aminoethylsulphuric acid.

Guthrie's first discovery was that by reacting cotton with 2-aminoe thylsulphuric acid in the presence of caustic soda solutions of mercerising concentration (say 17 to 25%) it was possible to cause the ethylamino group to combine with the cotton as indicated

in Fig. 2. The method employed consists of moistening cotton fabric with a 10% solution of 2-aminoethylsulphuric acid also containing 25% of caustic soda, then heating for 40 mins. at 100°C., and finally washing thoroughly. The resulting fabric contains about 0·56% of combined nitrogen indicating that there is one aminoethyl group attached to every fifteenth hydroxyl group in each cellulose chain molecule. Guthrie found that cotton so treated had unique properties, as for example, it dyed readily with acid wool dyes and showed increased resistance to rotting in soil burial tests. But more than this the fact that 2-aminoethylsulphuric acid could be so easily induced to combine with a cellulose fibres pointed the way to secure much the same kind of chemical combination with selected disperse dyes which contain sulphatoethyl (ethyl sulphuric acid) groups. One such dye is Solacet Fast Yellow which is believed to be obtained by coupling diazotised 2-(para-aminophenoxy) ethylsulphuric acid with para-cresol so as to have the formula shown in Fig. 3. When this

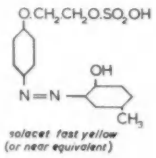


Fig. 3

dye is dissolved in strong caustic soda solution, padded into cotton fabric, and heated for one hour at 100°C. it combines with the fibres to give yellow coloured cotton by elimination of the sulphuric acid residue. The coloured cotton fibres thus owe their colour to the presence of the fibre-dye compound shown in Fig. 4.

In such a method of dyeing it is necessary for the applied dye to be soluble in strong caustic soda solution and experience has shown that this can be difficult to satisfy with the particular type of dye under consideration. However Guthrie did prepare a number of these special

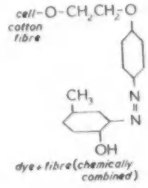


Fig. 4

dyes in which the diazotised 2-(para-aminophenoxy)ethyl sulphuric acid was coupled with dye intermediates other than para-cresol and in Table 1 are some of the dyes thus made and found capable of chemical combination with cotton:—

Table 1

Coupling Component	Colour Produced on Cotton Fabric
Para-Cresol	Yellow
Resorcinol	Yellowish orange
1:8-dihydroxy-naphthalene-3:6-disulphonic acid	Purplish red
1-amino-8-naphthol-4-sulphonic acid	Reddish blue
2-naphthol-3:6-disulphonic acid	Red
2-naphthol-6-sulphonic acid	Peach pink

The dye containing resorcinol was fairly soluble in alkali owing to the presence of the extra hydroxy group but in general it is a somewhat onerous condition that the dye must be soluble in caustic soda of mercerising strength—it would be much more convenient if a weaker alkali could be used.

Fastness Properties

It was found that by applying the above dyes the resulting shades were exceptionally fast to washing and in fact little loss of colour was produced by boiling the coloured cotton in 1% caustic soda solution for six hours. It could be readily demonstrated that the dyes were chemically combined with the cotton by first decolourising with sodium hydrosulphite (this splits the fibre-dye compound at the azo, —N=N—, linkage to give two amino groups one of which is on the fibre side) and then showing that this amino group exists by the fact that it can be diazotised and coupled to give a colour different from that of the originally dyed cotton.

From a consideration of the above cotton dyeing investigations it was thought possible also to colour cotton in much the same manner but using reactive dyes containing the chloroethyl group ($-CH_2CH_2Cl$) instead of the sulphatoethyl group ($-CH_2CH_2O.SO_2OH$). In applying such related dyes it could be expected that the chlorine atom of the chloroethyl group would react with the cotton fibres as shown in Fig. 5.

Guthrie investigated this possibility by first preparing 2-(para-aminophenoxy)ethylchloride corresponding

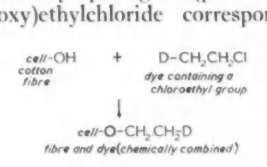


Fig. 5

to the 2-(para-aminophenoxy) ethyl sulphuric acid discussed above and then diazotising it and coupling it with resorcinol. This dye was then dissolved in strong caustic soda and applied to cotton fabric in the manner also previously described with the result that a yellow colouring was obtained due to combination of the yellow dye with the cotton. However, the alkali-solubility of these chloroethyl dyes was rather low so that deep shades could not be obtained. All this work of Guthrie has been of considerable scientific value in showing that dyes containing special reactive sulphatoethyl or chloroethyl groups can chemically combine with cellulose fibres to give colourings which have exceptional fastness to washing and alkaline treatments but unfortunately the requirements are such that practical dyeing procedures based on them do not appear possible.

Quite another method for combining a dye with cellulose fibres has been suggested by Kursanov and Solodkov (Zhur. Prink. Kim., 1943, **16**, 351) who found that certain pyridinium salts of the type given in Fig. 6 could

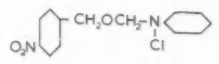


Fig. 6

be caused to combine with cotton by a baking process. In this case the union with the cotton takes a course so that pyridine and hydrochloric acid are split off and the remainder of the pyridinium compound is left chemically combined with the cotton fibres as shown in Fig. 7. Here again, the

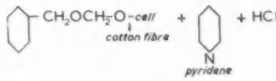


Fig. 7

nitro (NO_2) group can be reduced to an amino (NH_2) group which can then be diazotised and coupled with a naphthol (say beta-napthol) to give a coloured cotton in which the coloured component is chemically combined with the cotton as shown in Fig. 8.

It will be noticed that the dyes described above as being chemically

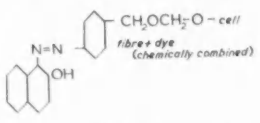


Fig. 8

combined with cotton or other cellulose fibre whether it be by direct reaction of the fully formed dye with the fibre or by the indirect method of first combining the fibre with one component of the dye and then reacting it with a second component are characterised by the fact that the attachment of the dye to the fibre is by an ether linkage, that is, by an oxygen atom. Thus the dye-fibre compound is of the type Dye — O — Fibre. This is an important feature since cellulose derivatives of the ether type are among those which are most stable. A good example of this is to be found in the methyl and ethyl cellulose ethers which are not decomposed by caustic alkalis except under drastic conditions. By comparison it is noted that cellulose *ester* derivatives are usually very easily decomposed by alkali treatment as illustrated by the ease with which cellulose acetate can be hydrolysed to give regenerated cellulose. Thus it will generally be most satisfactory in any method devised for combining dyes with cellulose fibres to ensure that the union is by way of a *ether* linkage.

Large Scale Work

With this background of information concerning earlier progress in the discovery of methods of dyeing cellulose fibres so that the dye becomes chemically combined with the fibre it is now convenient to turn to a more recent development which has resulted in a number of reactive dyes being actually introduced to dyers for large scale dyeing operations. These new reactive dyes are known as Procion (I.C.I.) and Cibacron (CIBA) dyes, and it would appear that they are similar in character to each other and require much the same conditions in their application. B.P. 797,946 of 1954 appears to be the master patent covering the Procion range of dyes but this is supplemented by others such as B.P. 774,925, 781,930, 785,120 and 785,222. The scientific aspect of Procion dyes has been dealt with by T. Vickerstaff (J. Soc. Dyers and Col., 1957, **73**, 237).

In order that a dye may be reactive and thus able to combine chemically with a cellulose fibre it must contain in its molecule a suitable reactive atom or group of atoms. In the dyes already mentioned the chlorine atom (C2) and the sulphato group ($O.SO_2OH$) have been shown to be effective in this way as chloroethyl ($-CH_2\ CH_2Cl$) and sulphatoethyl ($-CH_2\ CH_2O.SO_2OH$) groups. For the production of Procion dyes the reactive group is quite different since it is based on cyanuric chloride. The new dyes are formed with cyanuric chloride as one component in such a manner that at least one (more generally two) of the chlorine atoms are left in a condition such that they can react with cellulose.

Cyanuric chloride, first prepared as early as 1830, has only recently acquired considerable technical importance. It has the formula given in Fig. 9, and all three chlorine atoms are reactive towards cellulose although not equally so. Thus, if a dye be prepared so as to contain this substance with any of the chlorine atoms left free then the dye is potentially reactive towards a cellulose

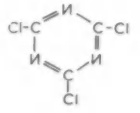


Fig. 9

fibre and capable of chemically combining with it. B.P. 797,946 covers the preparation of a number of such reactive dyes and the manner in which they can be used. The dyes favoured are of the azo and polyazo type and not only do they contain cyanuric chloride as a component but they also carry at least one ionogenic solubilising group such as a sulphonic acid group to give them desirable water-solubility. The cyanuric chloride component is generally linked to the remainder of the dye molecule by a nitrogen atom. Thus a Procion reactive dye will be typified by the structure indicated in Fig. 10 in which *D* represents one part of the dye

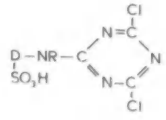


Fig. 10

molecule combined through the *NR* linkage (*R* represents a hydrogen atom or alkyl or similar group) to the cyanuric chloride residue with its remaining two reactive chlorine atoms free. When such a dye is brought into contact with a cellulose fibre in the presence of an acid-binding substance such as sodium carbonate or caustic soda the chlorine atoms take part in chemical combination between the dye and the fibre with elimination of these chlorine atoms and the formation of an ether linkage between dye and fibre.

The nature of such a dye and the manner of its application can perhaps best be illustrated by reference to a particular example. Firstly, the dye is made by diazotising 4-aminoazobenzene-4′-sulphonic acid and then coupling this under acid conditions with the condensation product of one mole of cyanuric chloride and one mole of 2-amino-5-naphthol-7-sulphonic acid (J-acid). These reactions are shown in Fig. 11. This

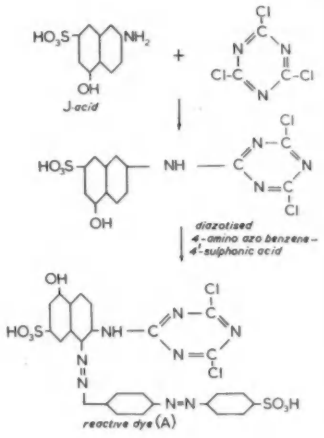


Fig. 11

dye may then be applied to cotton fabric by a process in which the fabric is padded with a 4% aqueous solution of the dye containing 2% of a highly sulphonated oil (wetting and dye dispersing agent), mangled to give a liquor pick-up of about 100%, and then dried at 40°C. The fabric is then immersed for 1 min. at 95°C. in a 6% aqueous solution of sodium hydroxide saturated with common salt. In this latter treatment the dye combines with the cotton fibres in the manner indicated in Fig. 12.

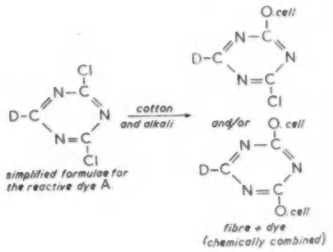


Fig. 12

As represented in Fig. 12 dye having two reactive chlorine atoms can react with either one or two cellulose molecules of the cotton fibre but it is also possible for it to react so as to cross-link either two parts of the same

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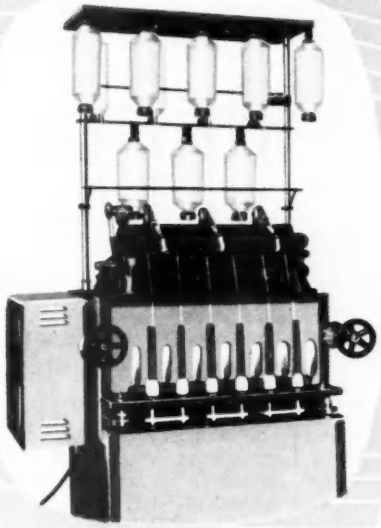

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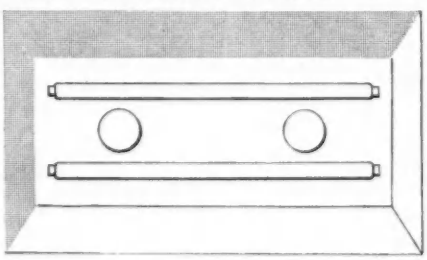

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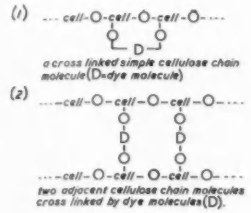


Fig. 13

cellulose molecules or to cross-link two adjacent cellulose molecules[2] as shown in Fig. 13.

It is possible that any or all of these reactions between the dye and cotton fibre occur during dyeing according to the conditions existing, but it is interesting to note that Vickerstaff has recorded the fact that the dyed cotton has lost its normal solubility in cuprammonium solution—this is a strong indication that the dye has effected a fair degree of cross-linking between adjacent cellulose molecules.

It is important that an acid-binding substance be present in the dyeing operation otherwise combination between the dye and the fibre does not take place. For example, if a neutral aqueous solution of the dye be dried into cotton fabric it is possible afterwards to remove the dye completely by washing in water; if the dyed impregnated fabric is treated with an alkali such as sodium bicarbonate then the dye cannot be removed by simple washing. Obviously for reactive dyes to combine with cellulose fibres the cellulose of which these are composed must not have been pre-treated to remove its hydroxyl groups. Thus ordinary secondary acetate fibres consisting of a cellulose acetate retaining only about 1/6th of the hydroxyl groups contained in the cellulose from which such fibres were made cannot be satisfactorily dyed with these reactive dyes—if the acetate fibres are treated with alkali to regenerate cellulose containing its full complement of hydroxyl groups then it can be dyed just as can cotton fibres.

Theoretically, it is possible for a reactive dye of this kind to combine with almost any substance containing hydroxyl groups and this raises an important question. Will the dye not react with the water of the dye liquor at the same time as it reacts with the cellulose fibres since water is a hydroxy compound? The answer, of course, is yes! It is therefore important to know the relative rates at which the reactive dye will react with these two components of a normal dye liquor and how it may be possible to influence the reaction so that the fibre will combine with most of the dye. But it may at once be stated that under the conditions recommended by the manufacturers of Procion dyes it is generally possible to ensure that at least 70% of the dye reacts with the fibres.

Fixation

Vickerstaff has given the fixation of Procion dyes special attention and has elucidated several features which play an important part in deciding how it is best to apply these dyes with a view to securing the highest degree of fixation in the fibre and so avoiding excessive waste of dye by its hydrolysis in the dye liquor. In the first place it can be assumed that in applying the dye to say cotton in a neutral dye liquor by a batchwise dyeing process as opposed to one which involves the use of a padding mangle the dye will be attracted to the fibre surface in proportion to its substantivity to build up a concentrated dye layer from which the dye will then pass into the interior of the fibre by a process of diffusion. Although the substantivities of the Procion dyes so far made available vary it would seem that most of these have a low to moderate degree of substantivity—it would be better if it was higher since this would favour the partition between dye liquor and fibre in favour of the fibre. To counteract a low substantivity it is better to use padding rather than batchwise dyeing methods.

Obviously the relative rates of hydrolysis of the reactive dye in water and fibre are important and it would be desirable for this rate to be high in the fibre and low in the water.

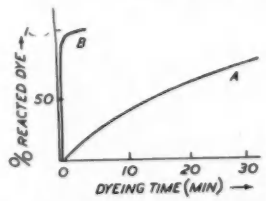


Fig. 14. Curves showing the relative rates at which Procion Brilliant Red 2B reacts with (A) water and (B) a cellulose fibre at room temperature

Vickerstaff has compared these rates (see the curves in Fig. 4) and finds that hydrolysis is practically instantaneous in the fibre and much slower in the dye liquor at room temperature. In general, hydrolysis in the water is favoured by an increase of temperature and also by using a higher concentration of alkali to bring about the hydrolysis. The manner in which the hydrolysis of Procion Brilliant Red 2BS in solution is influenced by temperature is shown by the data in Table 2.

Table 2

Temperature of Liquor	Time for 50% Hydrolysis
25 C.	13·8 min.
30 C.	7·7 min.
35 C.	5·3 min.

These data refer to a 1% (0·33% pure) dye solution containing 30 g. of common salt and 10 g. of sodium carbonate per litre (the solution has a pH of 11·1).

Although with some of the dyes the rate of attraction of the dye to the fibre may be relatively slow the rate of diffusion of dye into the fibre is generally high. The rate of diffusion increases with rise of temperature so that a high dyeing temperature would appear desirable from this viewpoint but unfortunately it has been found that the rate of hydrolysis of the dye in the dye liquor increases at a higher rate as the temperature is raised. Thus from all points of view it is generally better in batchwise dyeing to keep the temperature of the dye liquor low.

Any hydrolysis of dye which occurs in the dye liquor results in the formation of a coloured substance having a composition differing only from the reactive dye in that the chlorine atoms are replaced by hydroxyl groups—this substance may or may not be substantive to the cellulose fibre. The substantivity of the hydrolysed dye will be largely governed by the substantivity of the original reactive dye—the higher that of the original dye the higher will be that of the hydrolysed dye. Thus during dyeing under conditions in which excessive hydrolysis occurs the shade produced may be contaminated by absorbed hydrolysed dye and since this may have inferior fastness to light and certainly an inferior fastness to washing such contamination is highly undesirable. A good washing after dyeing is thus essential so as to remove any hydrolysed dye left in the dyed goods although it is a favourable point that the hydrolysed dye will be water-soluble.

The Procion and Cibacron reactive dyes have only been introduced to large scale dyeing comparatively recently so that not only are their methods of application being developed and improved as the result of research and experience but new members of this new class of dyes are from time to time being added to the range of dyes available. Already these

dyes have aroused great interest among textile colourists and they can be seen to allow in certain fields more economical and simple procedures to be employed than when the ordinary types of dyes are used. But there can be no doubt but that in the near future the reactive dyes will gain much further importance as more of them become available and as there is better opportunity to discard those individual dyes which cause difficulties of one kind or other. At the present time the following methods of application are being used.

In batchwise dyeing the normal procedure is to use a dye liquor prepared with dye and water only and to commence dyeing at room temperature. During the first one-half hour common salt (15 to 30 grams/litre) is gradually added since this promotes absorption of dye by the textile material. Then sodium carbonate (5 grams/litre) is added to effect combination of dye with the fibre and also promote further absorption (with simultaneous fixation) of dye by the textile material. The total dyeing period should not exceed say 1½ hours and usually the temperature need not exceed about 30°C. The curves in Fig. 15 relating to the behaviour of

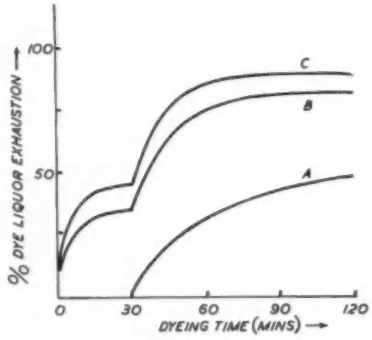


Fig. 15. Curves showing dye liquor exhaustion obtained in dyeing viscose rayon staple at 20°C. with a liquor/fibre ratio of 30 : 1 with Procion Blue 3GS under the following conditions—
(A) No salt in dye liquor.
(B) 25 g./l. of salt. (C) 50 g./l. of salt. With 5 g./l. of sodium carbonate added after the first ½ hour.

Procion Blue 3GS under such dyeing conditions have been given by Fox (Amer. Dye. Rep., 1958, **47**, p413). They show very clearly the beneficial effect on dye absorption of the addition of common salt during the first part of the dyeing procedure and also the further dye absorption which takes place as a result of the addition of sodium carbonate.

Padding Methods

When dyeing by padding methods but little difficulty need be experienced in preparing and applying the dye liquor since the reactive dyes are generally easily soluble, and since their substantivity towards cellulose fibres is relatively small this favours the production of uniform shades. In one padding method the liquor is prepared with the reactive dye and sodium bicarbonate (this alkali is too weak to promote dye reaction with either the liquor or the textile material during the padding operation) so that the padded fabric can then be dried over hot cylinders or otherwise—the high temperature causes the sodium bicarbonate to change to sodium carbonate which is sufficiently alkaline to induce immediate combination of the dye with the fibres. It is necessary to guard against uneven dye migration in the fabric during this drying and heating and from this viewpoint an addition of sodium sulphate to the padding liquor is advised. A typical padding liquor as given by Fox (supra) has the composition shown in Table 3.

Table 3

Procion dye	0 to 20 g./litre
Sodium bicarbonate ..	5 to 20 g./litre
Sodium sulphate ..	5 to 20 g./litre
An anionic or non-ionic wetting agent ..	2 g./litre

Padding is effected at 20 to 30°C. with the maximum liquor expression from the fabric. When it is intended to produce deep shades by this padding method it is useful to make an addition of urea (say up to 200 g./litre) since this ensures that the utmost tinctorial value is obtained from the dyes used. The above padding process may be modified by omitting the drying and carrying out a short steaming for say ½ to 1 min. In this way dye migration difficulties sometimes encountered in the drying stage may be avoided.

Another variation in methods for applying Procion dyes consists of padding the cotton fabric with the dye, drying, passing through a strong caustic soda solution containing added salt to effect combination between dye and fibre, and then perfecting this combination by passing the fabric through a steamer before washing-off. In a process of this kind it is possible to make use of a Standfast molten metal dyeing machine.

As noted previously all these methods are steadily being improved upon but as at present carried out they can result in the production of some very fast shades on cotton and viscose rayon materials. Washing fastness is especially high and many of the dyes have an equally high fastness to light but it will be appreciated that while chemical combination of a dye with the fibre can certainly favour washing fastness it will not necessarily favour high fastness to light—this latter type of fastness must be governed by the atomic structure of the dye apart from its reactive groups.

Procion Scarlet G— New Cold-Dyeing Dyestuff with Attractive Properties

PROCION SCARLET G—the latest addition to I.C.I.'s range of Procion specialities—is a homogeneous dyestuff whose main features are its ability to produce full, bright, yellowish-scarlet shades of good fastness to severe washing on cellulosic fibres, its good fastness to light on viscose rayon, and its outstandingly good batchwise dyeing properties on cellulosic fibres generally. Procion Scarlet G can be applied to the latter by all the methods—continuous or batch wise—established for Procions. On viscose rayon to be crease-resist finished, Procion Scarlet G, in addition to its value in self-shades, will be of interest as the red component in a wide range of fawns, browns and greys in combination with other cold-dyeing Procions, with which the new dyestuff is fully compatible.

When batch-dyeing cotton goods, optimum fixation is achieved by the use of tirsodium phosphate as the alkali, but soda ash is perfectly satisfactory for viscose rayon goods. In all cases when dyeing Procion Scarlet G, it is necessary to avoid the presence of copper ions in the dyebath. In printing, Procion Scarlet G is primarily of interest for self-shades, for which the good building-up properties of the new dyestuff are admirably suited. The printed shades possess good fastness to light and washing on cotton, viscose rayon, linen, chlorinated wool and on silk. Procion Scarlet G can be fixed by both the steaming and non-steaming processes and will yield good white resist effects when used in conjunction with resist agent PR.

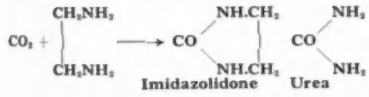
Cyclic Ethylene Urea or Imidazolidone

The attention paid to the imidazoles is interesting but the organic chemist may wonder if any of them are capable of demonstrating clear, decisive advantages on all points over the well-tried, inexpensive urea-formaldehyde.

By J. T. MARSH, M.SC., F.R.I.C., F.T.I., F.S.D.C.

ABOUT 1949 reports began to come from the U.S.A. concerning a new class of resin for textile finishing in the field of crease-resistance; these products were called *reactant resins* because they react with the cellulose rather than with themselves as do urea-formaldehyde and melamine-formaldehyde. The widespread application of these new finishing agents was somewhat slow, but the rise of the "no-iron" cottons in 1954 gave a great impetus to the use of reactant resins which has now spread to Europe.

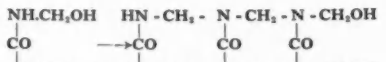
The best known member of this class is based on cyclic ethylene urea, a crystalline compound (m.p. 133°C.) which has been known as a chemical curiosity since its discovery by Fisher and Koch in 1886; it has some other names such as 2--imidazolidone, or 2-imidazolidinone, as well as 1 : 3-diazacyclopentan -2-one and 2 : 5 diazacyclopentan-1-one. The simplest preparation is from carbon dioxide and ethylene diamine as described by Mulvaney and Evans (Ind. Eng. Chem., 1948, **40**, 393).



The relation to urea is obvious from the formulae.

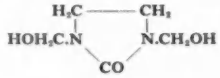
It is well known that urea is capable of forming dimethylol urea when treated with formaldehyde, and that this compound is polyfunctional because of the two reactive hydroxyl-hydrogens and the two reactive imino-hydrogens.

Hence it is possible for dimethylol urea to condense further with itself to make a thermosetting resin which possesses a three-dimensional network, of which simple representations have often been postulated.



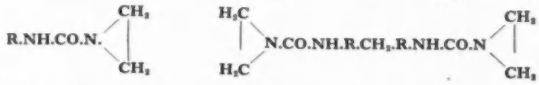
Another amino-aldehyde resin which is frequently used in textile finishing is melamine formaldehyde; this is capable of forming a hexamethylol derivative which again makes a complicated network structure when fully condensed to a thermosetting resin.

Cyclic ethylene urea, however, has only two reactive points, and although it is capable of forming a dimethylol derivative with formaldehyde, it is only bifunctional, and cannot condense to a thermosetting resin.

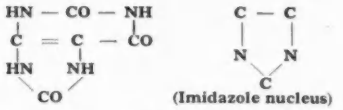


The dimethylol cyclic ethylene urea is sold under a number of trade names such as Zeset S, Rhonite R-1, Resloom E-50, Aerotex EU, and BT.324.

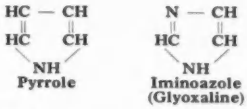
It is important that this product should not be confused with other ethylene ureas which, however, do not possess a heterocyclic ring structure. For example, linear ethylene ureas, known as Persistols, were made in Germany between 1939 and 1945 by the reaction of isocyanates with ethylene imine; these products are not used with formaldehyde but react directly with the hydroxyl groups of cellulose.



Although there is much to be said in favour of the simplest possible terminology for these new cyclic urea compounds, it is perhaps wise to place the correct name on record, namely 1 : 3-bis-(hydroxymethyl)-2-imidazolidone. The imidazole ring is well known as the five-membered ring in uric acid, and it is also found



in allantoin and in histidine. The azoles are compounds in which the methine groups of pyrrole and allied rings are replaced by nitrogen; such cyclic compounds are usually formed from amino-compounds and aldehydes or ketones.



The imidazole class contains numerous compounds.

Points of Interest

Cyclic ethylene urea, or C.E.U., has several points of interest in comparison with the U.F. and M.F. compounds. Its dimethylol derivative is quite stable in solution and does not form any precipitates which shorten the life of the impregnating bath; furthermore, when heated by itself it does not resinify and so may be used with advantage in embossing processes as it is readily removed from the rollers and does not clog the engraving. According to Cooke *et al* (Text. Res. J., 1957, **27**, 150) heating the dimethylol C.E.U. alone for four hours gave a linear polymer of seventeen units. It seems probable that methylene bonds are formed as follows.

In presence of cellulose, however, the dimethylol C.E.U. gives an in-

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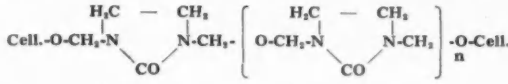
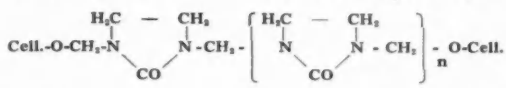
soluble product and there is evidence to show that this is almost certainly due to a cross-linking effect.

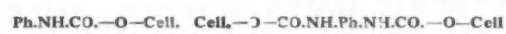


The precise nature of the linkage is not definite for the above structure could lose water to give the following arrangements, where the methylene bond would be more stable than the methylene ether linkage.



Additional evidence of cross-linkages with dimethylol imidazolidone may be seen from the fact that whereas both polyvinyl alcohol and D.M.C.E.U. are separately soluble in water, yet they combine to give a water-insoluble product, resistant to alkali but hydrolysed by acid.

Further important data concerning the probabilities of cross-linkages come from the fact that both monomethylol formamide and monomethylol acetamide react with cellulose, but no crease-resistance follows, nor is the product insoluble in cuprammonia. The contrast between monofunctional and bifunctional reagents is shown in the behaviour of the isocyanates and the di-isocyanates, for the latter impart crease resistance and insolubility in cuprammonia unlike the former.



Foster (Text. Res. J., 1957, **27**, 129) argues that as the effect of D.M.C.E.U. reaches its peak at about 11% of resin, and that only some 40% of the cellulose in cotton is accessible, this would correspond to one methylol group per cellobiose unit.

One great advantage of D.M.C.E.U. lies in its efficiency, for it is entirely employed in combining with cellulose to give the desired result instead of tending to combine with itself. General practice is to employ a solution which will give about 4% on the weight of cotton; this is less than required with melamine-formaldehyde and much less than with urea-formaldehyde. Like the other resins, D.M.C.E.U. shows the usual linear relation between tear strength and recovery angle, and also between tensile strength and recovery angle. There is little benefit in the use of a longer link between the cellulose chains, in the hope of a more flexible structure, for where two molecular proportions of C.E.U. are first combined to form cyclic ethylene urea *bis*-ethylene urea there is no improvement.

Views about the possibility of cross-linkages between the cellulose chain-molecules have often been put forward as an explanation of the crease-resisting phenomenon. The simplest reagent for cross-linking is formaldehyde which probably acts in the form of methylene glycol, $CH_2(OH)_2$, a bifunctional compound; its action, however, is accompanied by substantial damage to the fibre and its use is mainly restricted to the stabilisation of viscose rayon.

Attempts have been made to use other bifunctional aldehydes, i.e. the dialdehydes, in the hope that a longer and more flexible link will produce less embrittlement. Such attempts have not proved successful and where flexibility has been achieved, the extent of crease-recovery is poor.

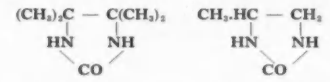
It would appear, therefore, that there must be a certain rigidity or stiffness about the cross-link if it is to be effective and this is in conformity with the behaviour of those synthetic resins which form a three-dimensional lattice and function by mechanical restraint of an elastic character as opposed to simple bridges between the chains; nevertheless, the two hypotheses have much in common, provided there is no undue insistence on the formation of a chemical compound between urea-formaldehyde (or melamine-formaldehyde) and cellulose.

It is suggested that the presence of a bulky cyclic structure in the dimethylol imidazolidone imparts the necessary amount of rigidity or stiffness to the long cross-link between the cellulose chains and so gives crease-recovery by true chemical combination without undue embrittlement.

At the present time, dimethylol ethylene urea is a most successful finishing agent for crease-resisting effects on cotton; in a very few years its application has grown to between 25 and 30% of resins used in the textile industry. It has high chemical reactivity, good resistance to washing, and good resistance to chlorine absorption; in addition, it is fundamentally efficient because it reacts with cellulose and not with itself. This latter factor has been used as a sales argument in the phrase "getting your money's worth from textile resins."

Derivatives

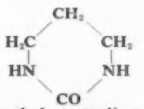
It is possible to produce various derivatives of cyclic ethylene urea from various diamines, according to B.P. 603,160; thus tetramethylene diamine gives tetramethyl ethylene urea, and propylene diamine gives methyl ethylene urea or methyl imidazolidone.



Tetramethyl ethylene urea

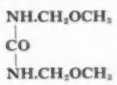
Methyl ethylene urea

Perhaps a more interesting compound is a six-membered ring structure obtained from trimethylene diamine and carbon dioxide.

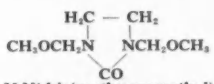


Trimethylene cyclic urea

In just the same way as it is easy to etherify the methylol derivatives of urea (and also of melamine) to give simple ethers of the type shown in the following formula:—



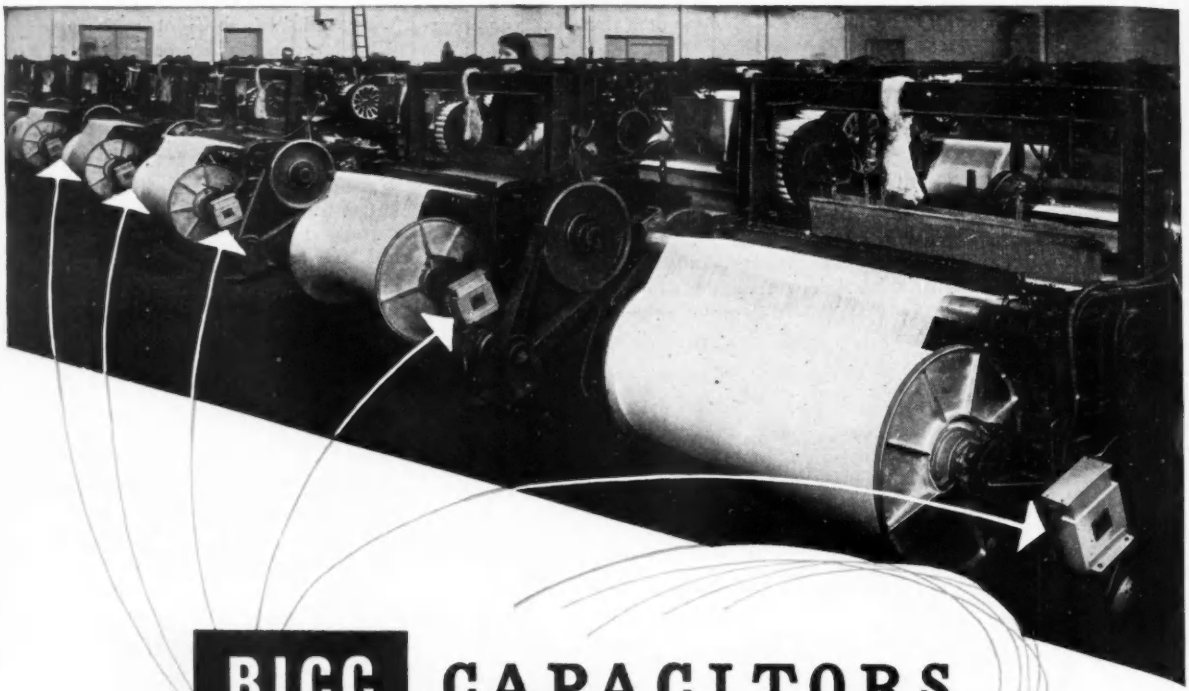
so it is possible to make the alkyl ethers of dimethylol cyclic ethylene urea, according to U.S.P.2 373,136.



N.N'-bis(methyoxymethyl) ethylene urea

Whereas the chief purpose of forming the methyl ethers of methylol urea or melamine is to impart stability, there is not the same necessity with the dimethylol cyclic ethylene ureas; however, the possibility of incorporating some of the longer alkyl chains means that one may utilise this technique in the field of water repellency, if required. Silicones are often used for this purpose for, in addition, they are beneficial as lubricants, reducing needle damage during stitching and improving the ripping strength of the treated cotton.

One very important point in the use of cyclic ethylene ureas lies in the low chlorine retention after being subjected to hypochlorite solutions in laundering. The amount of resin is much less than with urea-formaldehyde



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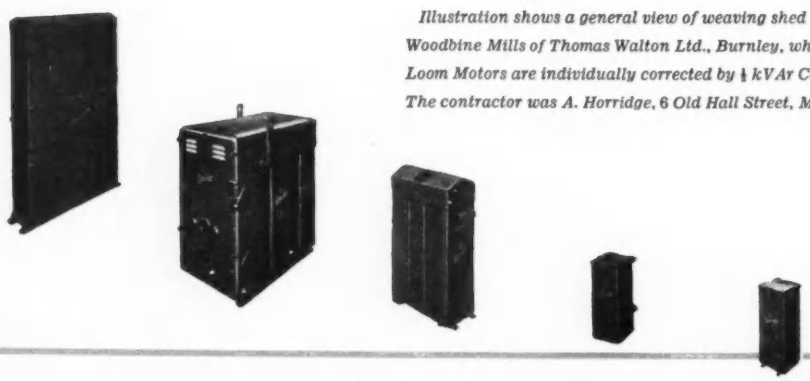

Illustration shows a general view of weaving shed in the Woodbine Mills of Thomas Walton Ltd., Burnley, where 192—¾ H.P. Loom Motors are individually corrected by ¼ kVAr Capacitors. The contractor was A. Horridge, 6 Old Hall Street, Middleton.

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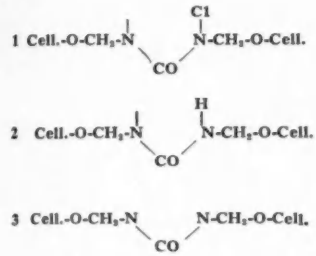
and both the nitrogen atoms are fully satisfied in a manner which does not permit the formation of the chloramides provided the treatment has been carried out properly.

Even though the cyclic ethylene urea resins give good all-round results on cotton goods, they are not entirely foolproof, for under certain conditions of acid hydrolysis the ring is broken and an active imino-group formed which, in turn, can produce a chloramide in presence of hypochlorites; these chloramides, as in the case of urea-formaldehyde, produce hydrochloric acid when heated with consequent damage to the treated goods.



It will be seen that although most amino-aldehyde resins are more or less suceptible to acid hydrolysis, this takes a somewhat peculiar course with cyclic ethylene urea in that the ring structure is broken.

A further potential difficulty is that some cases of interference with the fastness properties of dyestuffs have been reported and even some of the vat colours may have their light-fastness impaired with dimethylol cyclic ethylene urea.

Hence considerable care and skill are still required if the best results are to be obtained; metallic salts seem to be preferred as catalysts and it has been suggested there is some beneficial form of chelation with the ring structures which include melamine. The precise and exact application of dimethylol cyclic ethylene urea, including the best catalyst and other additions to the impregnating bath, should only be undertaken after seeking competent advice from those who are experienced in its use. As always, there is much to be said for operating under expert guidance, such as the Tebilized plan, which safeguards finisher and customer alike.

Although there is a substantial and growing use of dimethylol cyclic ethylene urea, it is almost entirely confined to the treatment of cotton goods and there is little if any application to rayon; this may possibly be due to the fact that its use would be uneconomic on rayon where higher proportions would be necessary to give a good effect. It may also be accounted for on the basis of "low chlorine retention" for as yet, the use of hypochlorites when laundering rayon goods does not seem to be common; nevertheless, when the irresponsible and careless use of hypochlorites is encouraged with cotton goods, it will not be easy to discourage their use with rayon or nylon or wool.

For crease-resisting rayon, and also "drip-dry" rayon, urea-formaldehyde condensation products continue to hold the field; in spite of many claims and advertisements about the treatment of cotton, there is no doubt that the proper use of urea-formaldehyde can give a finish which is not surpassed by any other resin and that many millions of yards have been used over the years without any complaints of damage by chlorine retention. Urea-formaldehyde is by no means a back-number, for even in the U.S.A. it still accounts for over 50% of the resinous condensation products used in textile finishing and in Europe the percentage will be even higher. Nevertheless, the impact of a new product which now commands about 25% of the field of resin finishing should not be minimised and due credit must be given to the ingenuity and enterprise associated with it.

To many textile chemists, as distinct from practical finishers, the chief interest of the cyclic ethylene ureas is not in "just another resin" but in the new light they shed on the whole theory of crease-resisting textiles and self-smoothing fabrics. The organic chemist, in particular, will find interest in the attention paid to the imidazoles, but will nevertheless wonder if any of them are capable of demonstrating clear, definite and decisive advantages on all points over the well tried simple and inexpensive urea-formaldehyde.

New Heat Shaped Textile Fabrics

SIGNIFICANT new design and engineering innovations in the production of radios, furniture, clothing and many industrial parts may now be possible through the use of special heat-shaped fabrics of Dynel acrylic fibre. The development, said to open a wide number of unique new uses for textile fabrics, utilises the thermal pliability of Dynel to achieve moulded, embossed or stiffened shapes by a simple heating, shaping and cooling process. Included among items that can be made with shaped fabrics of Dynel are covers for arm rests for furniture; fabric covers for radios; for outdoor furniture; industrial flange and valve covers; ribbed battery separators; stiffened interlinings for outerwear; and many decorative uses.

Union Carbide Corporation, New York, U.S.A., reports the shaping process in its simplest form is done by forcing a cold mould into a piece of fabric made of 100% Dynel that is clamped on the outer periphery and heated at 320°F. The fabric is held in shape while being permitted to cool. The clamped area can then be trimmed to size. The shaped fabric will retain its form until reheated to nearly the temperature of shaping.

Vacuum moulding, with short-time, high-temperature infra-red heating of the fabric, is also being used successfully. Woven and knitted fabrics of Dynel or blends of Dynel with other fibres may be shaped by the hot air process with moulds of wood, glass, metal, plaster of paris or papier-mache. The extent of shapeability, or distortion in the moulding operation, depends upon the number and size of yarns in the fabric. The twist of the yarns and the fabric weave are also factors.

Many woven fabrics have been drawn to stretch and set the warp or weft yarns to 160% of their original length in a single operation. Woven fabrics of fibre blends, such as Dynel with 25% cotton, have been drawn to an extention of 120% of original length. Non-woven felts and mattings of Dynel can be embossed or curved and stiffened to form products like cap visor linings, although deep-drawing is not generally recommended. Best results are obtained with woven fabrics of Dynel that have been piece dyed or boiled-off, rather than greige goods, to remove strains that might cause shrinkage due to uneven tensions in weaving and strains imposed during yarn manufacture. Similarly, knit goods can be heat shaped with greater success if finished beforehand.

The stiffness of a shaped fabric of Dynel is dependent on the temperature, time of heating and tension during heating. The greater any of these factors, the stiffer the cooled fabric will be. Use of lower temperatures and low tension will produce moulded fabrics of Dynel as soft as before shaping. Semi-rigid structures can be made, however, and for even greater rigidity, the shaped fabrics can be treated with resins.

Other variations of shaped fabrics of Dynel that have been developed include: deep pile fabrics embossed to give the effect of a curled hair surface for women's coats; flat-woven fabrics for men's hats; flat fabrics dimpled or ribbed to provide air spaces for heat insulation in special clothing; heat stiffened fabrics for light load-bearing structures; and others stiffened for cap visor linings and similar products.

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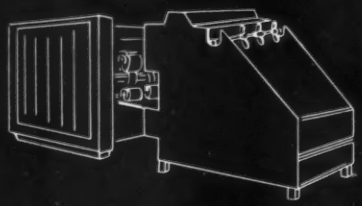

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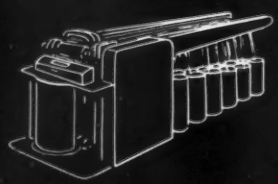

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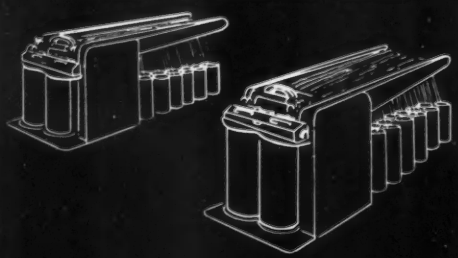

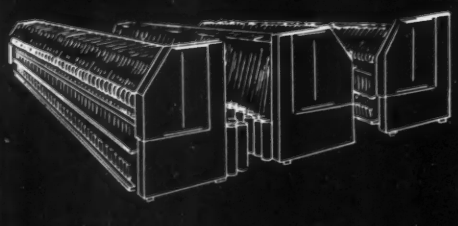

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Book Reviews

THE COTTON INDUSTRY IN A WORLD ECONOMY. International Federation of Cotton and Allied Textile Industries, 567 Royal Exchange, Manchester 2.

The official report of the International Cotton Conference, held in Venice in September, 1957, is here made available to a wider public. In his introductory address, the President of the Federation, Mr. W. T. Winterbottom, sought to measure the degree of attainment of forecasts of future trends given at the Buxton Conference of 1952 and to set the stage for subsequent speakers, the first of whom, Mr. Hans Mertle (Germany), presented a "General Survey of the Cotton and Allied Textile Industries of the World" under the headings "History," "Raw Material," "Production" and "Markets," ending with the admonition "Think constructively, not restrictively." From the Bombay Millowners' Association came a study of the scope of the cotton and allied textile industries of India, which discussed the complex character of the cotton industry with its three sections, viz. the organised mill sector of 465 spinning and weaving mills; the handloom industry, now enjoying state aid and patronage; and the decentralised power loom sector in units of one to five looms. This contribution to the Conference also included a note on the new hand-operated spinning wheel, with four spindles, known as the Ambar Charkha and brief statements on the production programme under the Second Five-Year Plan and the prospects for exports. Mr. Kojiro Abe, chairman of the All Japan Cotton Spinners' Association, spoke on the achievements and difficulties of the Japanese cotton industry since 1952 and its relationship to the overall economy, before touching on factors affecting the future of the industry. Japan's economy, said Mr. Abe, is predestined to be governed by the state of the country's international balance of payments, thus explaining Japan's efforts in the promotion of cotton textile exports. Measures taken to limit further expansion of productive equipment and to adjust export programmes were also outlined. Mr. W. J. Erwin's analysis of the position of the American textile industries in World Trade dealt with major events since 1952, with external influences and with the challenge and related opportunity facing the U.S. industry. The statement of fundamentals regarding a U.S. Government cotton policy, issued by the American Cotton Manufacturers Institute, accompanied Mr. Erwin's paper.

It was appropriate that, in a year of great discussion of European economic integration, lengthy consideration should be given to the Western European cotton industry. Dr. W. T. Kroese (Netherlands), well remembered for his masterly survey of the past, present and future of the cotton industry read at the Buxton Conference, assessed the present and future situation of the British and Continental industry, with its raw material problems, financial, technical and organisational embarrassments and marketing difficulties, and linked these questions with an expert study of such social aspects as shift-working, recruitment, training and education, working conditions, differences in labour costs in Western Europe and competition with Japan and the U.S.A. Dr. Kroese's paper, which was fully documented, was illustrated by excellent graphs and tables compiled by the Netherlands Institute of Statistics. These are reproduced in the report. Dr. Kroese had some pertinent remarks to make about the Common Market and, turning to the Free Trade Area proposals, he insisted on the cumulative processing definition for qualification as free trade area goods.

M. André Siegfried, of the Académie Française, gave a lucid exposition of current and recent structural changes in the world economy and showed how they were matched by changes in the cotton industry, and Professor Ray F. Harrod, of Oxford, dealt with the relationship between national income and consumer expenditure.

This 286-page report well merits careful study.

S.P.S.

* * *

DRY CLEANING TECHNOLOGY AND THEORY. A Report of the National Institute of Dry Cleaning. By A. B. Martin and G. P. Fulton. Inter-Science Publishers Inc., 250 Fifth Avenue, New York 1 (price $6.00).

A three-fold purpose actuated the authors of this monograph which was originally prepared for the Office of the (U.S.) Quartermaster General. They wished to offer, firstly, a comprehensive survey of dry-cleaning science and technology; secondly, to direct attention to the abundant literature devoted to research on aqueous and non-aqueous detergency; and, lastly, to provide a guide for planning further research. So well have they succeeded that this volume will appeal to readers well outside the narrow limits of the dry-cleaning industry—in fact, to all with any interest in textile chemistry. The authors point out in their preface that at one time or another, and either accidentally or by design, almost all known substances get on to textile fabrics, which are themselves extremely complex substances both chemically and physically. The dry-cleaner is further faced with the problem of restoring a treated garment to its original condition and appearance. A short account of the origins and growth of dry cleaning leads the reader to a chapter on the soiling of fabrics, including observations on the composition of natural soil and the requirements, application and measurement of artificial soils.

The nature of the detergent process and the role of secondary factors and the mechanisms of the removal of oil-soluble, water-soluble and insoluble soils are most thoroughly explained. Three chapters describe the requirements, composition and characteristics of solvents and of soap-based and synthetic detergents used in the industry and three further chapters with the colloid chemistry of non-aqueous solutions and moisture relations and electrical conductance in the dry-cleaning bath. Chapter XI (The Scientific Basis of Garment Finishing) and Chapter XII (Physical Effects related to Finishing) treat of the effects of water and heat and the mechanical properties of textiles, with an account of the creasing, wrinkling and shrinkage of fabrics. Physical changes in garments caused by faulty finishing are also touched on. The quality-seal on this outstandingly valuable work is given by the exhaustive list of references, 255 in number, with which the volume ends.

S.P.S.

* * *

PRACTICAL COTTON CARDING. By J. K. Clegg. Columbine Press, Old Colony House, South King Street, Manchester 2 (price 21s.).

As a preliminary to his explanation of carding machinery and operations, Mr. Clegg summarises the processes preceding carding and therefore essential to the production of good sliver. The remainder of the volume is concerned with the three principal routine operations, viz., grinding, setting and flat maintenance with separate chapters on card assembly and such miscellaneous maintenance operations as flat re-clothing, taker-in maintenance and the flexible-wire clothing of cylinders and doffers. Particular attention is given to maintenance programmes. The photographs and diagrams are excellent.

* * *

CHAMBERS'S TECHNICAL DICTIONARY. Edited by C. F. Tweney and L. E. C. Hughes. Rev. Ed., with Suppt. 1958. W. and R. Chambers Ltd., 11 Thistle Street, Edinburgh 2 (price 35s.).

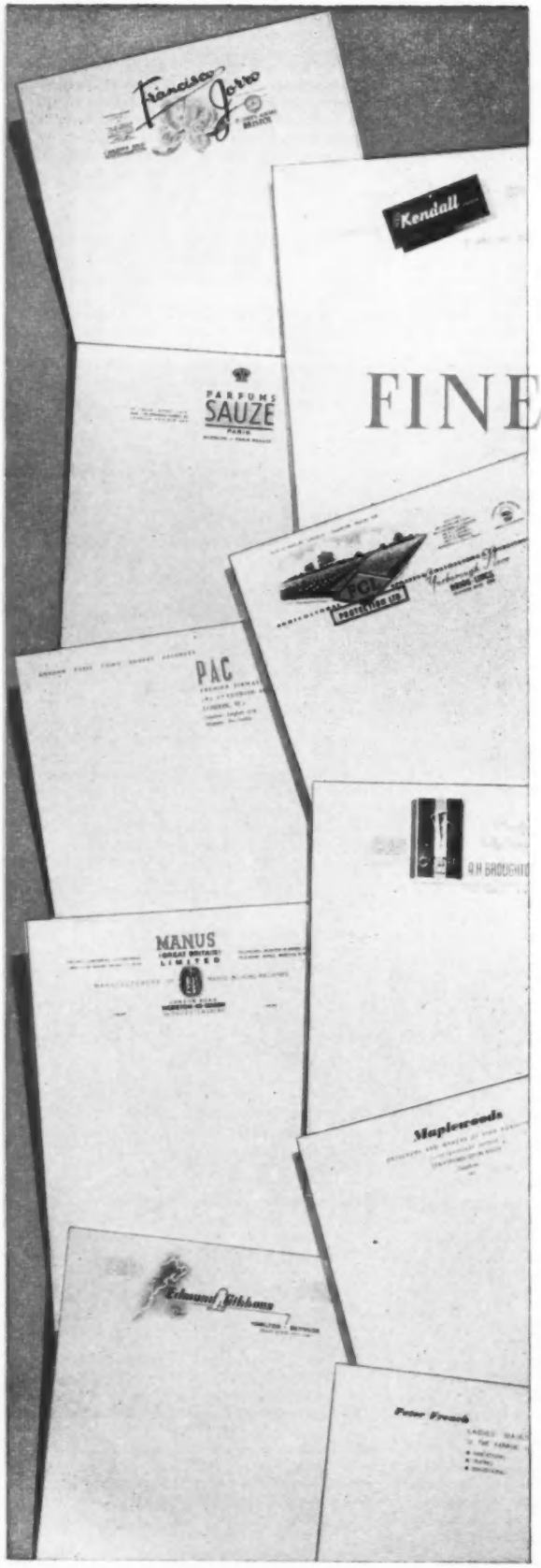
"Chambers's" has long had a high reputation as a wholly reliable standard reference work to which one could turn for the definition or origin of a scientific or technical term with every confidence. The editors of the latest edition have, with the co-operation of experts in 120 branches of scientific and industrial activity, so carefully and extensively revised the definitions, that all the entries are thoroughly up to date in meaning, connotation, etymology and pronunciation. The main body of the Dictionary contains some 55,000 entries covering over 900 pages and, for good measure, there is a 74-page supplement of almost 5,000 entries for important new terms, including some from the dyestuffs and plastics industries. This is emphatically a "must" for all executives and technicians seeking the meaning of unfamiliar terms.

* * *

WOOL. Barclays Bank D.C.O., Economics Dept., 54 Lombard Street, London, E.C.3 (no charge).

The reader is fittingly invited to sample the contents of this 148-page book by an attractive cover-design with a sheep motif and will not be disappointed on proceeding to the text. The volume gives an ably-written conspectus of the wool industry and trade starting from the various breeds of sheep, raw wool classification and marketing and passing on to woollen manufacturing processes and the trade in tops, wool yarns and textiles. Wool production in South Africa, Australia, New Zealand and the United Kingdom receives considerable attention and there is a short account of wool research activities. Twelve pages of four-colour graphs, thirty-three photographs and numerous tables amplify the text and a glossary of terms used in the sheep and wool industry completes the volume.

S.P.S.



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Trade Literature

"WIGGIN NICKEL ALLOYS *v.* CAUSTIC ALKALIES." This is the title of a publication issued by Henry Wiggin and Co. Ltd., Thames House, Millbank, London, S.W.1, describing the properties of the high-nickel alloys used in the construction of plant handling caustic soda. Extensive data, giving comparative corrosion rates from a large number of both laboratory and plant tests, form a useful guide in the selection of the best grade of material. Copies are available without charge to chemical engineers and designers.

* * *

INDUSTRIAL BURNER CONTROL SYSTEMS. A new data sheet from Elcontrol Ltd., Wilbury Way, Hitchin, Herts., covers the operation and use of the firm's range of industrial flame failure and ignition programming controllers. Two types of equipment are described: the F.S.M. units for infra-red flame radiation detection and the F.S.P., a new introduction making use of photo-electric flame detection. All the units described are available either in cradle and chassis form suitable for mounting in complete control cabinets, or in steel, cast aluminium or cast iron cases.

* * *

LABORATORY EQUIPMENT. An 80-page, profusely illustrated catalogue from Loughborough Glass Co. Ltd., Loughborough, covers their full range of laboratory apparatus. The catalogue has been compiled by combining previous catalogues of interchangeable and general equipment with sundry leaflets describing specialities produced by the company. For ease of reference the catalogue has been divided into three parts, each arranged in alphabetical order, they are: Interchangeable Laboratory Glassware, Plastics Laboratory Equipment and General Laboratory Equipment.

* * *

AIR CONTROL. Thirty-one applications of pneumatic control applied to various industries are contained in a booklet recently released by Benton Stone Ltd., Aston Brook Street, Birmingham 6. Photos illustrating these applications are "stills" from the firm's new colour film "Air Controlled." The film is available for hire on application to the above address.

* * *

DRY FILM LUBRICATION. An illustrated leaflet from Stedall Machine Tool Co., 145-157 St. John Street, Clerkenwell, London, E C.1, announces "Everlube" dry film lubrication, a fused-to-the-part lubricating compound composed of resins scientifically blended with lubricating pigments. The leaflet states that subsequent to initial application "Everlube" is unaffected by extreme heat, solvents or vacuums, can be run dry, or in conjunction with oil or grease and is particularly applicable where contact between lubricant and product must be prohibited.

* * *

KENT ELECTRONIC UNITS. An informative leaflet available from George Kent Ltd., Luton, Beds, contains brief details and concise technical data relating to the company's range of high sensitivity amplifiers, the Type 2 reference unit and the D.C. power pack.

RENOLD CHAIN DRIVES. The first of two multi-colour leaflets produced by Renold Chains Ltd., Renold House, Wythenshawe, Manchester, describes the Mk. 5 Coventry chain. Developed specifically for slow speed driving and conveying under rough all-weather conditions, the Mk. 5 is of all-steel construction incorporating a non-ferrous metallic coating which resists corrosion. The roller chain principle is employed, and this combined with hardened steel bearing surfaces is claimed to ensure smooth running and minimum friction. The second catalogue illustrates and briefly describes the company's range of chain drives.

* * *

AUTOMATIC METERED LUBRICATION SYSTEM. Tecalemit Ltd., Plymouth, have recently published an excellent booklet fully describing the Tecalemit-Bijur automatic metered lubrication system. This incorporates a central lubricating point—either hand or automatic—which discharges a controlled volume of oil to the various lubrication points on the machine. Oil is accurately apportioned and controlled by meter valves on which are stamped seven flow settings thus allowing the requisite amount to reach the point regardless of distance from the lubricator or variation in bearing fit. Different types of valve are illustrated and briefly described, together with basic lubricators, fittings, junction boxes and pressure gauges.

* * *

GLYCERINE—1,700 WAYS TO USE IT. United Kingdom Glycerine Producers' Association Ltd., 5 Bridewell Place, London, E.C.4. Besides being a long-established ingredient in hundreds of products in a wide variety of fields, glycerine is constantly finding its ways into new and improved products. At present, it is an ingredient in over 1,700 processes and compositions, all of which are listed in this booklet. In addition to known uses, glycerine is also incorporated in many undisclosed formulae. In foods and beverages; pharmaceuticals and medicinals; in paints; in paper and printing; and in countless other products; glycerine's role as a humectant, as a preservative, as an emulsifier, as a solvent, etc., is universally recognised. Copies of the booklet are free.

* * *

OVERHEAD HANDLING EQUIPMENT. British Monorail Ltd., Wakefield Road, Brighouse, Yorks. A comprehensive catalogue, giving details of the company's range of automatic transfer and overhead handling equipment, is a spirally-bound, two-part catalogue designed for use as a reference book. The first of the two sections describes individual pieces of equipment—tracks and suspension equipment, girder rails, trolleys and switches, etc.—supported by illustrations, specifications and dimensioned drawings. The second section consists of reports, photographs and layouts of actual monorail installations, illustrating how the system has helped to overcome various handling problems posed either by particular industries or by individual factories and warehouses. A feature of the design of the catalogue is that each page is a complete leaflet in itself, dealing either with one piece of equipment or illustrating a particular type of installation.

* * *

NICKEL APPLICATIONS. The August issue of "Nickel Bulletin" (Mond Nickel Co. Ltd., Thames House, Millbank, London, S.W.1) contains over eighty abstracts of papers, the diversity of which reflects the wide range of industries and applications in which nickel plays a major part. In the section concerned with heat- and corrosion-resisting materials, two items of particular interest give details of recently developed tests for evaluation of the resistance of austenitic steels to intergranular corrosion. In other abstracts, reference is made to comprehensive papers on stress-corrosion cracking, inhibition of corrosion by fuming nitric acid and by residual oil ash, and the resistance of nickel-containing materials to various other corrosive media.

* * *

ENGLISH ELECTRIC PUBLICATIONS. The first two of five new brochures released by English Electric Co. Ltd., Stafford, describe two types of motor controller: the ½ h.p. Magamp motor control unit, and the uni-directional speed controller for 2 or 3 h.p. d.c. motors. The remaining three deal respectively with B.S.D. ventilated motors from ½ to 50 h.p., the Red Spot heavy duty fuseboard and the UJ44, U35, CJ46 and Skeltag open type sub-station fuse gear.

* * *

"FARADEX" THREAD GUIDES. Steatite and Porcelain Products Ltd., Stourport-on-Severn, Worcs, have recently published an excellent descriptive leaflet concerning their range of "Faradex" thread guides. "Faradex" is an exceptionally hard material of the litania class and has been used extensively in the processing of nylon, "Terylene," glass, etc., with excellent results. Sole agents in the U.K. are Northern Mill Supply Co., East Didsbury Station, Manchester 20.

* * *

ALUMINIUM DEVELOPMENT ASSOCIATION. 33 Grosvenor Street, London, W.1. The 1958 editions of the following three publications are now available on request, "Directory of Members"; lists names and addresses of member companies, together with corresponding details of administrative and sales offices. Also includes a guide to available products. "List of Publications"; the 1958 edition comprises a new "Symposium Series" section, consisting of six volumes containing papers and discussions on various aspects of aluminium use and practice. "List of Films and Wall Charts"; nearly 60 sound films (16 mm.) are classified in this edition, plus particulars of 35 mm. film strips and available wall charts.

* * *

BUILT IN STARTERS. The trend in modern industrial design towards smooth, clean contours has led Allan West and Co. Ltd. to design a complete range of flush mounted, built in starters and accessories. This new range is illustrated in an attractive folder and is available from Allen West and Co. Ltd., Brighton.

1835 1845 1855 1865 1875 1885 1895 1905 1915 1925

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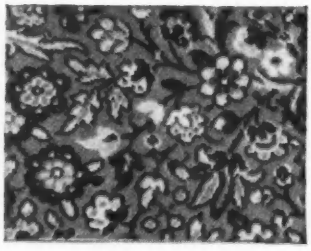
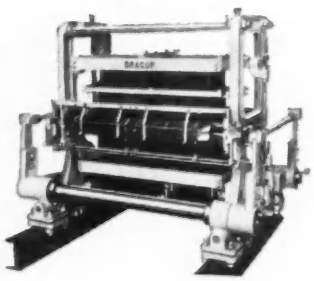
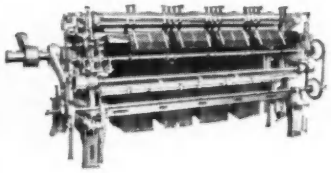
In the year 1825 Samuel Dracup founded a Jacquard Machine business destined to become world-wide in importance. The textile industry of the world now acknowledges that Jacquard machines by DRACUP are the finest obtainable. They step up production, reduce operational overheads and have a range of pitches and capacities to meet all purposes.

We invite you to weave better, faster and cheaper with Dracup Jacquards.

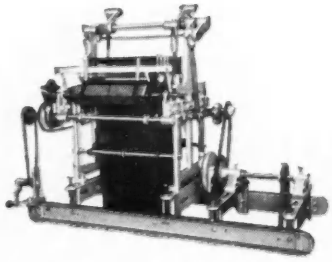




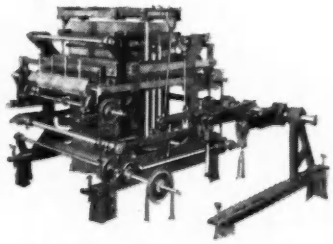
Heavy duty matting Jacquard for SISAL and COIR matting. Available in all sizes up to 24/4.



8/4 Single Wilton Jacquard for high speed production. Machines also available for Double Wilton carpets. Both types supplied any size in any pitch.



New type coarse pitch double lift single cylinder Jacquard. Available in all standard sizes. Double cylinder machines of similar design also available.



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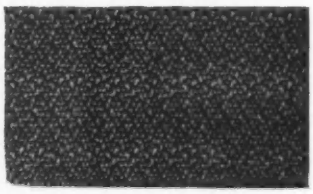

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Export Opportunities

U.S.A.:
Woollens, Linens, etc.

The Johnson-Lieber Company of 2505 N.E. Pacific Avenue, Portland 12, would like to receive quotations from U.K. exporters for light-weight woollens, linens, etc. Established for over 50 years, they are experiencing a substantial increase in business, and have organised a new division for developing new lines. The firm have branches in Spokane and Seattle, Washington, in Anchorage, Alaska and in Boise, Idaho. In addition, they utilise the services of 38 salesmen in covering the entire Pacific northwest. Exporters interested should write direct giving quotations showing f.o.b. and c.i.f. prices in U.S. currency, also copy correspondence to the British Consulate, Commercial Section, 715 Lewis Building, Portland 4, Oregon.

Mexico:
Ramie Thread

Madreyfus S.A., Calzada de Nonoalco No. 459, Mexico 4, D.F., want to contact a U.K. manufacturer of best quality ramie thread of 16/2 and 20/3 (metric) counts. Madreyfus S.A., who were established in 1934, are in business as manufacturers, importers, wholesalers and distributors of dyestuffs, colours, chemicals, etc. for the textile and leather industries. Manufacturers interested should write direct, also notify the British Embassy, Commercial Section, Lerma 71, Colonia Cuauhtemoc, Mexico 5, D.F., P.O. Box 96 Bis.

Canada:
Material for Nurses' Uniforms

J. H. Hunter Co. Ltd., 199 Water Street, Vancouver 3, B.C., want to contact U.K. manufacturers of cotton piece-goods suitable for nurses' uniforms. They are an old-established wholesale firm handling linens, sheetings, curtains, blankets, etc., and already do a substantial business with the U.K. Manufacturers interested should send quotations direct, also notify the U.K. Trade Commissioner, The Mercantile Bank Building, 540 Burrard Street, Vancouver, B.C.

Western Germany:
Lace Net

Hans Loewel, Bamberg Kunigundendamm 47, would like to represent U.K. manufacturers of lace net curtain material. Established in 1950, he claims to have connections with department stores and curtain factories, and employs six travelling salesmen. Manufacturers interested should write direct, also notify the British Consulate-General, Munich 13, Akademiestrasse 7.

U.S.A.:
Knitting Machine Yarns

John W. Roby & Co., 9045—16th Avenue, S.W., Seattle 6, Washington, are interested in purchasing from the U.K. knitting machine yarns. The company are interested in the import of knitting yarns on consignment, such yarns being kept in their bonded store until retail orders are received. The firm are prepared to cover the whole of the U.S.A. Their import financing is generally on a letter of credit basis. Suppliers interested should write direct with quotations showing both f.o.b. and c.i.f. prices in U.S. dollars, also copy correspondence to the British Consulate-General, 1805 Exchange Building, Seattle 4, Washington.

Western Germany:
Worsted Yarns

Ludwig and Co., Augsburg, Oberer Graben 47, would like to represent a U.K. manufacturer of worsted yarns. Established in 1940, they import and wholesale yarns and represent German, Swiss, French and Belgian manufacturers of woollen yarns. Manufacturers interested should write direct also notify the British Consulate-General, Munich 13, Akademiestrasse 7.

U.S.A.:
Hydraulic Hose

Mr. A. W. Andrews, 1734 Candler Building, Atlanta, Gerorgia is seeking U.K. sources of single and double wire braided hydraulic hose in sizes $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$ in., also the same specifications for rayon braided hydraulic hose. Manufacturers interested should write direct to Mr. Andrews with quotations showing both f.o.b. and c.i.f. prices in U.S. currency. also copy correspondence to the British Consulate, Commercial Section, 422 Hurt Building, Atlanta 3, Georgia.

Bahrain:
Carpets and Carpeting

J. E. Khedouri, P.O. Box 37, Bahrain, are interested in receiving quotations from U.K. manufacturers of carpets and carpeting, and cotton and rayon curtaining material. They are an old established firm of textile merchants, and manufacturers interested should write direct, also notify the Commercial Secretariat, British Political Residency, Jufair, Bahrain.

Canada:
Felt

E. F. Walter Ltd., 8225 Labarre Street, Montreal, have a demand for a woven felt used in the piano trade with cotton warp and weft. This material is required in 42 and 48 ins. widths in rolls of about 70 lbs. per roll. E. F. Walter Ltd. would purchase in quantities of about 300 lbs. per order with estimated annual requirements of 1,200 lbs.

Western Germany:
Piece Goods

Mr. H. Engert, Mannheim, Duererstrasse 97, is interested in obtaining U.K. agencies for twills for industrial clothing (blue jeans); flannels for men's pyjamas and workers' shirts; and shirtings in brightly-coloured patterns suitable for children's clothing. He has selected these items because he is particularly well-introduced to the clothing manufacturers using these materials. Mr. Engert, also an agent for industrial cloths, covers Baden-Wuerttemberg and Bavaria. Manufacturers interested enquiry should write direct also notify the British Consulate-General, Sophienstrasse 24B, Stuttgart.

Bermuda:
Blankets, etc.

"The Woman's Shop," Reid Street, Hamilton, Bermuda, would like to contact U.K. suppliers of good quality, coloured woollen blankets in "pretty yellows, soft pinks, etc." "Orlon" and nylon sweaters for children are also required. "The Woman's Shop" is one of the Gibbons' Group of companies and supplies a wide range of women's and children's wear and general household goods, in the medium and lower price ranges. Manufacturers interested should write direct also notify the U.K. Trade Commissioner, Barclays Bank Building (P.O. Box 393), Kingston, Jamaica.

New Zealand:
Steel Fabrication and Assembly

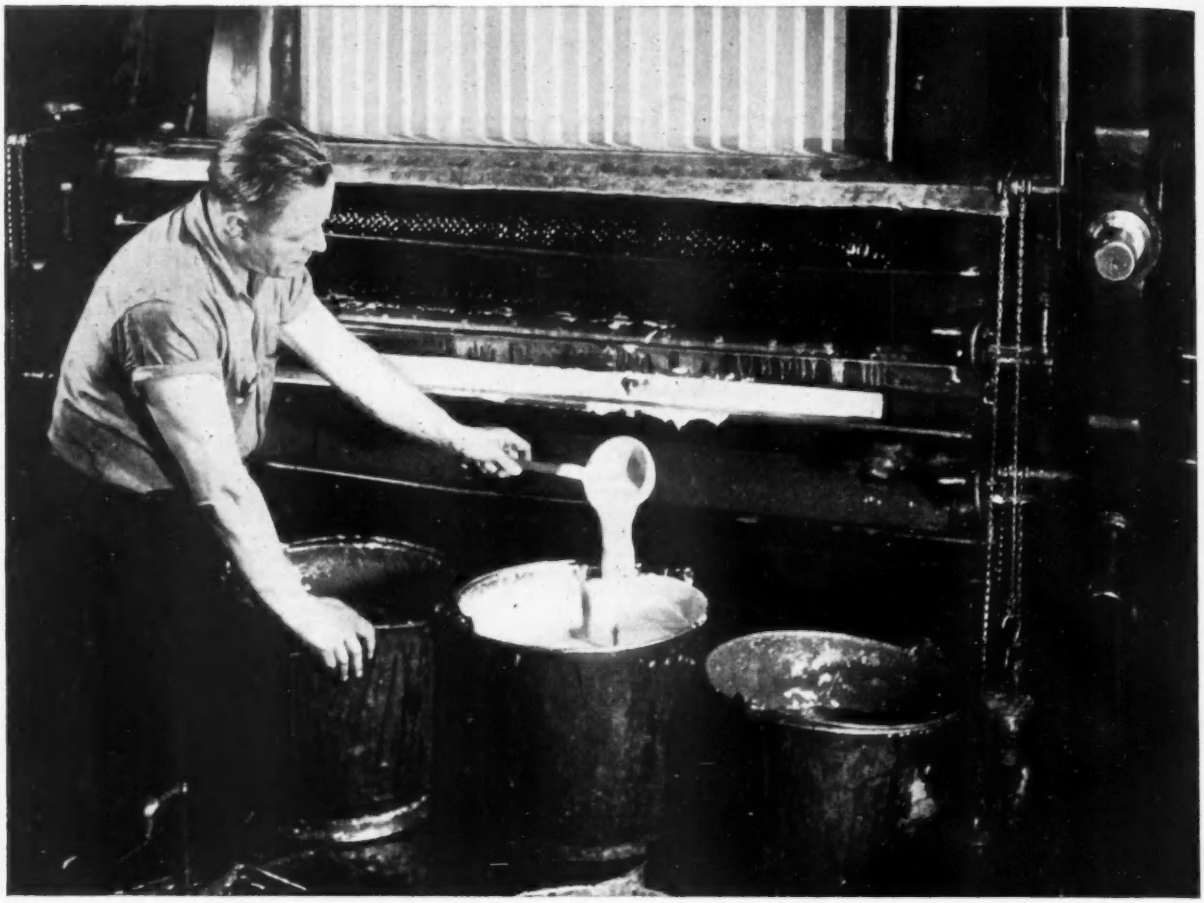
Fletcher Steel and Engineering Co. Ltd., Gt. South Rd., Penrose, Auckland, S.E.6, want to contact U.K. firms with a view to manufacturing under licence and marketing products involving the fabrication of steel, machinery and assembly. They have sales offices in the four main centres in New Zealand and have 15 representatives in the field. Manufacturers interested should write direct, also notify the U.K. Trade Commissioner, Queen's Arcade Building, Customs Street East, P.O. Box 1476, Auckland.

Canada:
Nylon Tricot Fabric

Austin Glove Manufacturing Co., P.O. Box 1088, Sherbrooke, P.Q., want offers from U.K. firms on three-bar nylon tricot fabric of 15 or 20 den. with glove finish, for manufacture of women's gloves. The fabric may be any width up to 55 ins. The order is likely to be between 4,000 and 6,000 yds. Manufacturers interested should write direct, also notify the U.K. Trade Commissioner, 1111 Beaver Hall Hill, Montreal, P.Q., that they have done so.

U.S.A.:
Baler and Binder Twine

Bob Stone Cordage Co., 4 Knox Road, P.O. Box 10224, New Orleans, are interested in quotations from U.K. suppliers for (*a*) baler twine, packed two 20-lb. balls to a bale (quantities—large lots) and (*b*) binder twine, 500 ft. per lb. packed six 8-lb. balls to a bale (quantities—large lots. If the firm are successful in obtaining suitable sources of supply, repeat business is likely to follow. Suppliers interested should write direct with quotations showing both f.o.b. and c.i.f. prices in U.S. dollars, also copy correspondence to the British Consulate-General, 403 International Trade Mart, New Orleans 12, Louisiana.



How to set the pace in fastness

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What was needed was a simple method of better protecting the pigments against severe abrasion. Today's solution is one in which CHEMIGUM LATEX plays a major role. Easily modified with other materials and mixed into the colours at the printer's, CHEMIGUM LATEX helps form a protective coating which locks in the pigment particles. The end result sets the current pace in fastness to crocking, plus even further improving resistance to washing.

Putting a liquid lock on pigment colours is one of many textile uses for CHEMIGUM LATEX. Its high binding strength, flexibility, light colour–and resistance to washing, dry cleaning and age–are finding wide application in binders, coatings, finishes and adhesives of all types. To learn more about CHEMIGUM LATEX–contact your nearest Goodyear Chemical Distributor.

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Textile Trade and Prospects

Cotton Yarn and Cloth Markets

Trade in yarn and cloth throughout September did not assume important dimensions in any single section. The long awaited revival in some instances looks even farther away than ever with some people inclined to the view that this stalemate has not yet reached its lowest point. One or two spinners report a little more inquiry but this is no pointer to improving business. The probable thing is that a little of the business that formerly went to some of the closed mills is now being evened out among those still fortunate enough to be running. Yarns on the whole have been very sparingly purchased and only for immediate requirements. Some firms that ordered yarns months ago are not taking their regular deliveries; some have instructed spinners to reduce the weekly off-take. In the transactions put through medium count mule and ring twists have had most support but the tone is far from happy. Fine, combed doubling wefts lack support, although certain types of hosiery qualities have been in better request. Blended yarns, spun rayons, and novelty fancy effects still sell reasonably well but in these types the margins are often unsatisfactory. Coarse numbers and condenser yarns are perhaps moving a bit faster but it needs much greater impetus all round before the general position becomes healthier.

Cloth operations have been very patchy indeed. A dreadful atmosphere of despair seems to permeate business. It is not to be wondered at, of course, in view of the fearful obstacles facing managements today. Nothing of real importance has appeared yet in connection with continuing heavy imports of cloth from abroad. The trade itself is no wiser regarding the talks with Hong Kong and India. Mills continue to close down and skilled operatives are being lost forever to the trade. In the meantime a huge exhibition of textile machinery accessories and instruments is taking place but present circumstances give little or no encouragement for Lancashire mills to even think of installing new machines with the out look as black as it can be.

The appalling dullness is woefully reflected in the dismal production statistics. Trade is certainly no better but what little has gone through has mainly been confined to replacements in dress goods. Interest has been shown in smartly designed dobby, jacquard, screen and roller printed cloths in the medium price ranges. The cheaper types of cotton shirtings are finding a few more customers and some very good value prints are now obtainable in fast colours and decent quality cloths. Furnishing fabrics are not being taken up as quickly as manufacturers hoped. In the total turnover as much printed materials have been sold as jacquard and dobby patterns. Some remarkably good duplex prints in contemporary styles have attracted buyers but the volume moving is pathetically low. The position is all the more infuriating when one realises the overwhelming sales potential if only the price was right. Price is, undoubtedly, the key to this problem—a problem which will never be solved by hoping for the best when competition for the spending power of the public increases steadily from other consumer goods. Overseas trade is still small and markets at one time almost exclusively British now seem well supplied with cloth and yarns from competing countries. A few lines have gone through to certain Dominion and Commonwealth markets.

British Wool Marketing Board and Wool Merchants

The report of the Committee of Investigation into complaints made against the operation of the British Wool Marketing Scheme, 1950, has now been published. The investigation was made at the request of the Country Wool Merchants' Association and the Wool Federation of Scotland, which lodged a number of complaints. Although the report states that in some matters the conduct of the Wool Marketing Board is open to serious criticism, on most points it finds in favour of the Board and rejects the wool merchants' request for the right to appeal to arbitration. The merchants had complained of the alleged arbitrary conduct of the Board during negotiations for the contract between merchants and the Board. They objected in particular to the offer of a one year contract alleged to be subject to such terms as would make its acceptance tantamount to commercial suicide, or a five-year contract at rates representing a 10% reduction on existing rates of remuneration.

"The history of the negotiations shows in our view that the five-year contract with its reduction in margins, although valid in law, was virtually imposed upon the merchants," states the Committee's report. "On the other hand, we are clear that it is the Board's duty to ensure that the clip is collected, graded and stored as economically as possible and that the Board are within their rights in settling what they are prepared to pay their agents. While we think the Board should be careful to consult the merchant organisations on matters which concern them, we are of the opinion that it would be contrary to the public interest for the Board to be bound to obtain the agreement of any or all of these organisations before offering a contract to individual merchants. Further, we do not think that the reasonable interests of the merchants necessarily require that their average remuneration should be arrived at by the traditional method of estimating their average costs and adding an allowance for profit, and we consider that the Board must be free to abandon this traditional approach to remuneration. We do not recommend the re-opening of the negotiations on the contract remuneration rates as sought by the complainants."

The merchants also objected to the setting up by the Board of an experimental handling unit at Oak Mills, Bradford. This complaint is rejected by the Committee of Investigation. "We find that the action of the Board in setting up the experimental handling unit at Oak Mills was not contrary to the reasonable interests of the members of the complainant organisations, and we recommend that no action be taken as regards this complaint," the report continues. "Moreover, we consider that it is in the public interest that the Board should be free to set up experimental units, and it is right that the Board should acquire practical knowledge of the services which they require their agents to perform."

Of the general relationship between the Board and its agents, the Committee states: "We consider that the scheme should make specific provision for a special Committee for negotiation between the Board and the merchant organisations concerning the amount to be paid to merchants and for enlisting the good offices of an independent person who would act as a consultant and help the two sides to resolve any differences that arise. We do not, however, recommend that the scheme be amended so as to provide a right to appeal to arbitration for the merchant organisations in any dispute between them and the Board."

Linen Trade Review

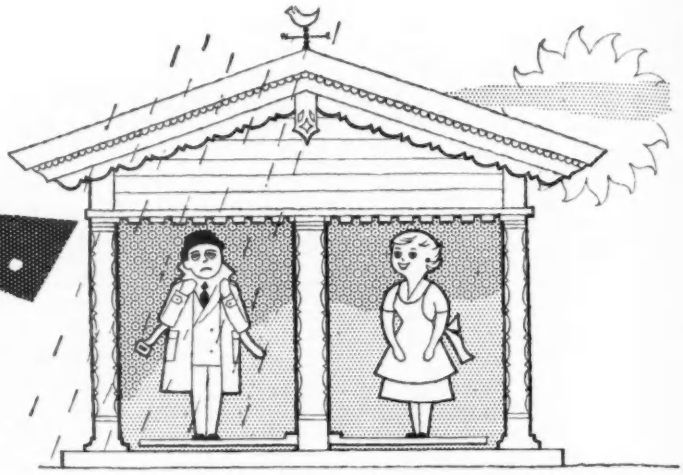
Manufacturers are hoping that relaxation of credit restrictions and the greater borrowing facilities may provide a much needed stimulant to demand. Some, however, are of the opinion that borrowers may be inclined to cut down their purchases of every day consumer needs—including textiles—to help meet their commitments on larger ventures. By mortgaging the national income to an even greater extent than at present, future prospects for an expansion in demand which would be sufficient to set in motion idle spindles and looms are not bright.

In the present difficult trading conditions many consider that closer co-operation between the banks and trade in the matter of credit facilities would, in the long run, benefit both. Instances, reminiscent of the lean twenties, are to hand of repercussions throughout the trade when the activities of an individual concern are brought to a halt through the sudden stoppage of credit facilities. The more liberal attitude now adopted towards small borrowers could, with advantage, be extended to industry.

Trading conditions are dull. While some mills managed to accumulate a reserve of orders during the annual holiday stoppage to enable them to maintain output on a restricted scale others have had to curtail production. A few have closed down temporarily, and casualties are still occurring, principally in weaving, finishing

Wet or fine...

hot or cold



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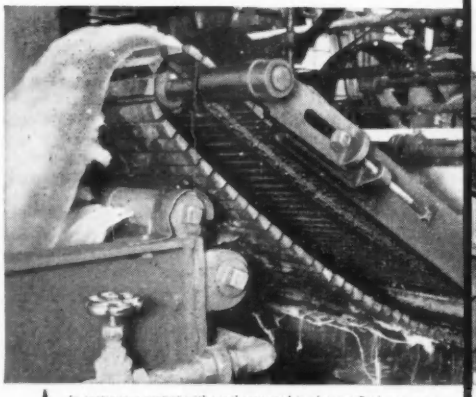
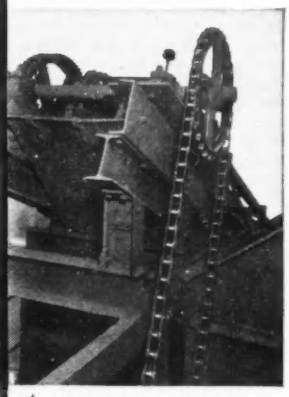
steel roller chains as a replacement for malleable chains on slow speed drives and light conveyors on all kinds of machinery and plant where operating conditions are bad and the chains are not enclosed.

Write for Catalogue Ref. 116/101 for full details, dimensions and prices.



In continuous contact with wool saturated in cleaning fluid, containing waste from previous washings, The Coventry Mark 5 chain on this wash-bowl carrier is still giving trouble-free service after over three years' continuous service.



Working without lubrication and covered in coke dust, the Coventry Mark 5 chain on this conveyer headstock drive continually handles 90 tons of coke per day.

★ runs easier

★ lasts longer

★ works better

whatever the weather it's a fine chain!

RENOLD

RENOLD CHAINS LIMITED · MANCHESTER

and merchanting. The fact that demand has tended to decline as the supply of ready money in consumer markets at home and abroad has decreased suggests that a corresponding reduction in retail prices might help to stimulate interest. While retailers support this view manufacturers emphasise that current prices permit no further reduction, and state that in some instances, far from providing a profit margin, they allow only a partial return on fixed charges.

While the suitability of linen in relation to its end use is unquestioned in its traditional markets the advent of man-made fibres has challenged its monopoly of many of these. The merits of linen are too widely recognised to require the lavish expenditure at present incurred on advertising campaigns. If this could be devoted to a reduction in retail prices the results would undoubtedly be more spectacular. The consumers' estimate of value is based on the price of competitive goods, and to say that they must be prepared to pay economic prices to prevent firms from operating at a loss is to shelve the issue. The onus is on the manufacturer to sustain demand by the quality, price and novelty of his products.

With the retting season now practically ended there has been a resumption of activity in scutch mills. It is now clear that the 1958 crop has suffered considerable weathering during harvesting and drying, which must adversely affect yield and quality. Scutchers are restricting operations in an effort to boost prices, but with demand from the spinning section limited to small parcels for immediate cover deliveries of low and medium grade material are ample for present requirements. Top grade fibre continues in short supply and any lots offered find a ready market at firm prices.

The linen handkerchief trade has declined in recent years, attributable partly to the challenge of competitive textiles, and to the increasing use of paper substitutes which to combat this the Irish Linen Guild has launched a campaign to restore interest in linen handkerchiefs. This includes the production of a standard size and quality men's pure linen handkerchief, measuring 18 ins. by 18 ins., with punch hemstitched border, to retail at 2s. 11d. made up singly in an attractive package.

Even with output substantially below productive capacity in the spinning section a considerable percentage of this is being exported, so that the supply of flax yarns to home factories constitutes a relatively small percentage of their total consumption, which includes yarns from practically all natural and man-made fibres, alone or in blends. This diversification of production has contributed materially to the fortunes of the industry and offers scope for further development.

Man-Made Fibres, Yarns and Fabrics

There has been a slightly brisker tone in the past month, although the filament side is slack at present and demand is not very promising. For most classes of staple the demand has been more buoyant in recent weeks. Despite this, however, many in the industry are inclined to take a somewhat gloomy view about future prospects, particularly because of expressed fears about a "large-scale" exporting of made-up garments to this country from Empire sources. Cheap imported goods from Hong Kong may develop on a greater scale it is thought and whether cotton or rayon, the result would be less purchasing power for British-produced goods. One thing is pretty certain: that the quality of made-up goods from Hong Kong is likely to improve sharply in the not too distant future. But taking present demand and not future prospects as the criteria, indications are that the dress goods trade may return to something like normal, judging by a more brisk forward buying, especially for chemically-treated rayons. The call, too, for new finishes in respect of curtain material and household furnishings is good, and furnishing fabrics generally are more prominent in demand.

Blends of "Terylene" and cotton are reported to be selling well, as are blends of cotton and nylon in yarn form, especially for the Midlands trade; in the north-west the newer fibres are finding good applications at present. From the West Riding, despite more "recession" talk, the demand for "Terylene" is steady and blends on the woollen system are for wearing apparel, and furnishing fabrics. Although the overall demand for worsteds is reported to have fallen, there is nevertheless a steady call for blends of "Terylene" with wool, and in the cheaper price ranges, blends of wool and rayon.

From the Midlands comes news of further worries by Continental garments in demand at present. The Italians appear to offer the main source of competition in this field. Knitters are finding themselves faced with the twin-difficulty of a good quality at a reasonable price plus first-class styling. There has been a suggestion that the present goods being offered in the shops come within the category of "dumped" and that anti-dumping legislation should be invoked by the Government. Whether this will reach the stage of official representations being made to the Government is a moot point, however. As far as home knitters are concerned, the "boom" in coloured nylons for the ladies continues, albeit in a minor key: but certainly the "bloomed" nylons has given a new impetus to crepe nylons. Again, in knitted underwear, there is a good call for all-nylon vests.

Jute Fibre, Yarn and Cloth

August prices of raw jute have declined on the average by £10 per ton and despite this the position remains weak. Arrivals of loose jute from up-country in East Pakistan have been steadily increasing and with the full weight of loose white jute coming on the market prices have declined. Many Continental countries have been in the market for supplies and China purchased 50,000 bales but this had no steadying influence on prices. So far as U.K. spinners were concerned no large buying has taken place and business has been mainly for small quantities to cover immediate needs. The outlook is that prices will go lower but it is unlikely the fall will continue at the present rate. Once shippers have sold fair quantities the currency received should enable them to remain out of the market and hold for higher rates. However, the main weight of the Daisee and Tossa crop has still to come on the market and it may be nearer the end of the year before a substantial rise in prices occurs.

So far the trouble in the Far East has had no effect on the market but if any serious developments should take place this could alter the whole outlook.

It is expected that the out-turn of the present crop should be in the vicinity of 7,500,000 bales for Pakistan which is considerably larger than in past seasons. The fact that India is nearing self-sufficiency in raw jute and will require to purchase less from Pakistan can also have an influence on prices of jute to be exported.

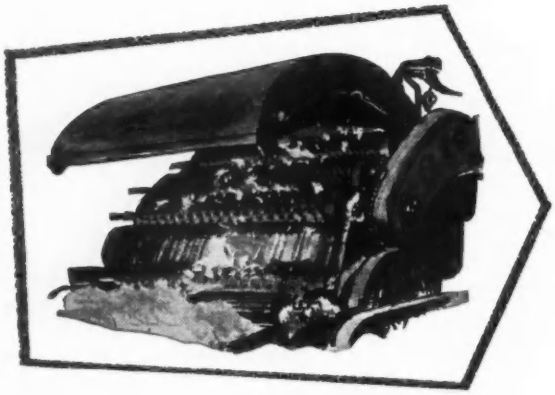
U.K. spinners are careful about the purchase of raw jute at present. The recent fall in prices has meant that values of stocks held by them have had to be written down by approximately £10 per ton and it is more than ever necessary that future purchases have to be made as near the bottom of the market as possible to permit the averaging of stocks.

Mill Firsts are offered at £106, Mill Lightnings at £89, Mill Hearts at £79 and grade Hearts at £66, c.i.f. U.K., Sept./Oct. shipment. Grade Tossa-2/3 is at £104 and grade Tossa-4 at £94 10s., with Continental Tossa-2/3 at £89. Crack Daisee-2/3 is now available at £94 and grade Daisee-2/3 at £88, c.i.f. U.K., Oct./Nov. Although E.P.C. levels have been reduced on a few occasions during the past month there are still shippers willing to accept less than the official prices. The Calcutta goods market has also become easier and although prices have declined fairly steadily, the fall has not been so great as in the case of raw material. Only a small interest has been shown by U.K. buyers and other countries have been purchasing only their immediate needs. Stocks of hessians held by Indian mills are now at the lowest level for a long time.

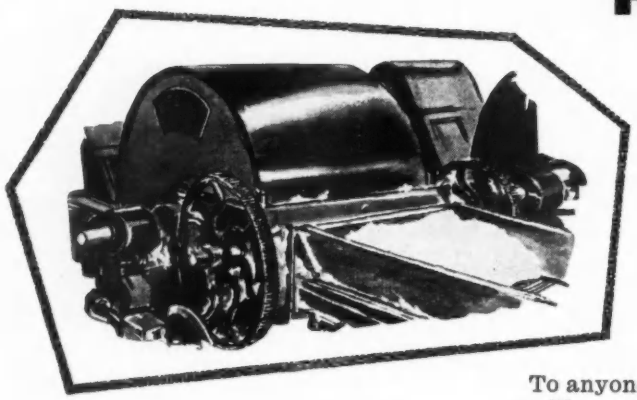
Quotations are now at 60s. 6d. for 10 oz. 40 in., and at 46s. for 7½ oz. with 11 oz. 45 in. at 66s. 11d. per 100 yds. f.o.b. Calcutta for Oct. shipment. B twills were quoted at 146s. Oct.

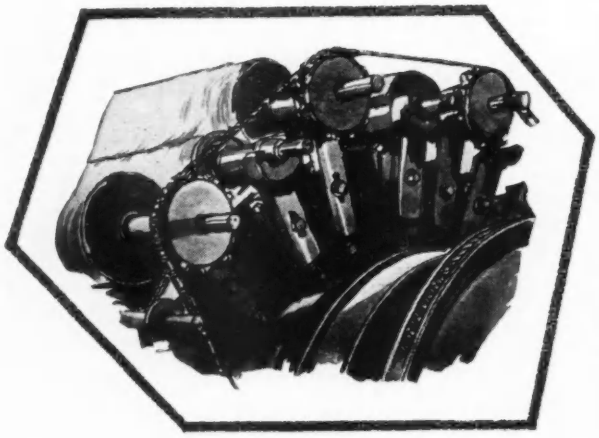
Due to the fall in raw jute prices, selling rates for yarns and cloth in the U.K. were reduced by approximately £5 per ton on August 20. However, this did not bring out much buying interest as the position in Pakistan remained weak and it was possible to bring a further reduction of £5 per ton into force on Sept. 2. Little additional business has been placed as the raw material position is still weak and there has been a further fall of £1 to £2 per ton. Consumers are purchasing only immediate requirements and are showing little interest in the forward delivery.

Spinners and manufacturers in Dundee and district still have fair orders in hand from business placed during the Middle East crises in July. Many orders placed then were of a speculative nature and specifications in many instances have so far not been given. Orders placed at that time are now approximately £10 per ton above the values ruling today. The heavy end of the trade have considerable orders in hand but there is a lack of new business coming in. Consumers are only placing small follow-on orders and are reluctant to commit themselves to substantial quantities for forward delivery. The jute industry generally is busy at present, and there is every prospect that this will continue for the rest of the year. Prices are now at a more realistic level, which should eventually attract buyers to carry larger stocks especially with cheaper money now available.



DO YOU RECOGNISE THESE?





To anyone in textiles a rag grinder, a tenterhook willey and a carding engine are so familiar that they are hardly worth a second glance. But they are worth a second thought—for friction and foreign matter in these machines have been the starting point of many a disastrous fire.

Today, however, the fires that they cause in raw materials and fly can be stifled in seconds with a fine cloud of dry powder. Electrical and oil fires can also be killed completely, before they take hold. *Today is the new age of Nu-Swift.*

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IN THE NORTH to Nu-Swift Ltd., (Dept N175), Elland, Yorkshire. (Elland 2852)

(TMF10)

Notes and News

New Amines

Two new amines, 1,3-diaminopropane and imino-bis-propylamine, are announced by Union Carbide International Company, Division of Union Carbide Corporation, 30 East 42nd Street. New York 17, N.Y., U.S.A. Soluble in water and common organic solvents 1,3-diaminopropane, a water-white liquid, is a raw material for textile crease-resistant resins with, it is stated, improved scorch-resistant properties. Since the compound has bifunctional amine groups, it is of interest as an intermediate in the synthesis of ion exchange resins, surfactants, rubber chemicals and dyestuffs. Imino-bis-propylamine is expected to be of value as a raw material in the production of textile softeners. Its structure also suggests possible use in the synthesis of such products as dyestuffs, rubber chemicals, and surfactants, and as a catalyst for polymerization reactions.

A More Opaque 'Terylene' Yarn

I.C.I. Ltd., Fibres Division, have recently added to the current range of filament yarns a 50 den./24 fil. extra dull yarn. This will facilitate the production of new fabrics with greater opacity and reduced lustre for the shirt, blouse, lingerie trades, etc. The yarn is available on parallel tubes for flat knitting and on standard waisted tubes for use when the yarn is to be processed. Price is 12s 9d./lb.

Change of Address

Longclose Engineering Co. Ltd. have now moved into their large new works and offices at Crescent Works, Dewsbury Road, Leeds, 11.

New Canadian Sales Company

Brook Motors Ltd. have formed a Canadian subsidiary, Brook Electric Motors of Canada Ltd., with offices at 250 University Avenue, Toronto. Business commenced there October 1, and director and vice-president of the new company is Mr. A. E. Hogton, who was formerly a director and vice-president of the Brook American subsidiary in Chicago. Personnel who have left the British organisation for Canada are Mr. H. W. Lumb, who will handle sales, and Mr. R. Booth, in charge of commercial and office organisation.

U.S. Cotton Acreage

At the beginning of July cotton farmers had only 12·4 million acres under cultivation, the least since the 1880's, says a Barclays Bank D.C.O. message from its New York office. The Department of Agriculture feel that present conditions indicate that cotton production this year may decline to 10·4 million bales, the smallest crop since 1950. Due to a sudden wave of demand, cotton fabric prices have risen to the best levels of the year. This increase is partly due, says the Bank, to current international events but also to low inventories at clothing factories and retail stores and the fear that raw cotton costs may rise sharply this autumn.

Warner Medal Award

The Textile Institute has awarded the Warner Medal to Mr. E. Lord of the British Cotton Industry Research Association, Didsbury, Manchester 20, in recognition of outstanding work in textile science. Mr. Lord joined the B.C.I.R.A. in 1930 and his published series on "The Production and Characteristics of the World's Cotton Crops," is now a world standard work. He has also contributed regularly to the annual Review of Textile Progress, and has earned high recognition in the statistical field for his works on statistical methods, particularly in connection with "The Use of Range in place of Standard Deviation in the t-Test." He has contributed papers to the Journal of the Textile Institute.

Productivity in U.K. Wool Textile Industry

More wool goods were being produced by fewer workers in U.K. mills, said Dr. A. B. D. Cassie, Director of Research at the Wool Industries Research Association, Torridon, Leeds, who recently told an apprentices' conference that this was one of the results of scientific and technical progress. Speaking on "How electronic developments and new inventions will affect our industry during the next 10 years," Dr. Cassie said it was generally recognised that about 20 years elapsed between the time an invention was conceived and the time when it bestowed its benefits in full production. Any view of the future must therefore be linked with a survey of the past decade, and the latter showed that an enormous increase had taken place in the productivity of the British wool textile industry.

Wool consumption in Britain since 1920 has increased from about 400 to 600 million lbs. per year, though the number of operatives over the same period has decreased from about 200,000 to 160,000. Output per operative in terms of wool consumed had therefore increased substantially, and the increase in yardage output was relatively even greater. Technical advances, which included the introduction of a number of electronic instruments, had played a large part in achieving this increase. Electronics, for instance, were employed in securing greater regularity, i.e., count control, in worsted yarns both for hosiery and weaving trades, and it had been established that, in this field, Britain was doing a better job than her competitors. Quality control with the aid of electronic equipment was expected to make big strides in the next 10 years.

Off Again to Further Exports

THE mobile exhibition of George Kent Ltd., Luton, Beds., has set off for another extensive tour of the Continent and Scandinavia. Since its previous spell abroad showing industrial instrumentation, the exhibition has had an encouraging reception at a number of important industrial centres in the U.K. Now, fitted with the very latest electronic developments, it is scheduled for visits to Sweden, Norway, Denmark and Poland, in full co-ordination with the members of the Kent sales organisation in the territories concerned. Before the exhibition returns in early December, its travels will also have taken in Belgium and East and West Germany.

The Kent mobile exhibition leaving en route for Tilbury

new

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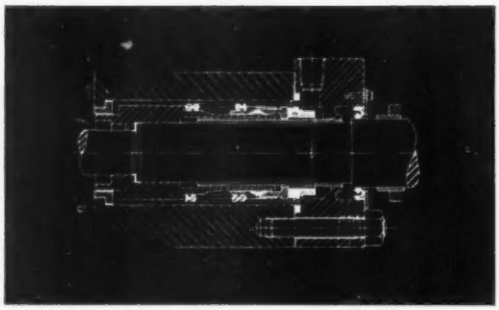
flexibox mechanical seal

type RRH

for high temperature

high pressure · high speed applications



The new Flexibox Mechanical Seal type RRH is designed to positively prevent leakage from the glands of high speed rotary shaft equipment operating at temperatures in excess of 800°F (427°C) and pressures up to 800 psig (55 kg/cm²gge).

This major gland sealing development has been achieved **with only a single seal** by incorporating a special cooled sleeve in the basic Flexibox design. This maintains the seal faces at low running temperatures while the equipment itself is handling fluids at much higher temperatures.

Applications include boiler feed pumps and high temperature/high pressure process pumps handling petroleum fractions, gases and chemicals.

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New Vapourproof Fitting

A NEW 150-200 w. vapourproof tungsten wellglass fitting, for use in chemical plant and similar situations, is announced by A.E.I. Lamp and Lighting Co. Ltd. The fitting has a corrosion-resistant LM-6-M aluminium alloy canopy, tapped for top entry (1 in. electrical thread), and a heat-resisting wellglass protected by a galvanised wire guard. There is a 14 ins. dia. P.V.C. reflector available as an optional extra and the fitting can also be supplied with either a 45° angle entry or conventional side entry.

A.E.I. standard top entry vapour-proof tungsten wellglass fitting

The wellglass is held in position by the galvanised wire guard by means of a screwed pad with brass wing screw fastening which exerts pressure on the wellglass and "Neoprene" sealing gasket. To re-lamp the fitting the pressure pad is released and the wire guard may then be lifted and rotated to free it from the top casting. The glass and guard is still retained in position by one lug and can be hinged to one side for re-lamping. The unit is supplied complete with lampholder to take 150 or 200 w. Mazda lamps with E.S. caps.

Discussion Evenings

During the international textile machinery exhibition at Belle Vue, October 15-25, 1958, the Manchester and District Section of the Textile Institute has arranged two discussion evenings at the Midland Hotel, Manchester. On October 16 the topic will be "Problems Associated with High Speed Weaving", the opening speaker being Mr. D. Brunnschweiler, M.Sc.Tech., F.T.I. (Manchester College of Science and Technology). On October 22 the subject will be "Productivity of Modern Cotton Spinning Equipment," with Mr. G. H. Jolly, M.B.E., A.C.I.S., A.C.W.A. (Federation of Master Cotton Spinners Associations Ltd.) opening the discussion. Each meeting will commence at 7 p.m. The opening speaker will introduce the subject for 10-15 mins., and an open discussion will then take place under the chairmanship of Mr. A. Croasdale, F.T.I.

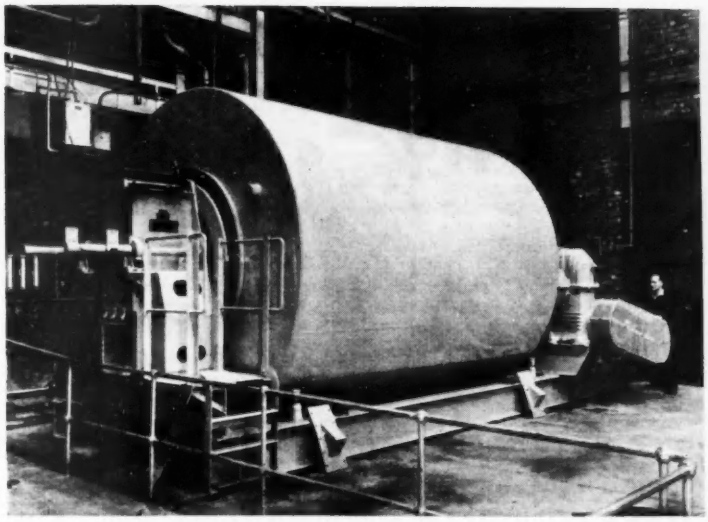
New Development at Freuchie

A small, compact unit probably working two or three shifts to obtain maximum productive efficiency, is to be started at Freuchie, Fifeshire. Named Eden Valley Fabrics (Freuchie) Ltd. they will manufacture industrial fabrics. It was announced a few months ago that the present occupiers of the factory, W. Lumsden and Son Ltd., linen manufacturers, would concentrate production at their Kirkcaldy factory where they are at present installing the modern automatic looms and generally transforming the layout. A spokesman for the Scottish linen trade said the new firm showed a faith in textiles in a traditional textile area. One of the problems at Freuchie had been labour but installation of high-speed looms and other machinery would offset the difficulties in this respect.

Blending Fine Polymer Powders

THE picture below shows one of the largest powder blending machines ever to be made in the U.K., at the works of Sturtevant Engineering Co., who designed and manufactured the unit. It is destined for the new "Acrilan" factory being built in N. Ireland by Constructors John Brown Ltd., where its purpose will be to obtain a homogeneous blend of very fine polymer powders. The unit is approximately 25 ft. long overall, 13 ft. high and 12 ft. wide. It has an uncharged weight of approximately 17 tons, and is capable of blending single batches of up to 450 cu. ft. in volume.

The shell and all material contact surfaces are lined in corrosion resistant material, and the entire machine is arranged for internal purging with inert gas. The intake and discharge box forms a unit at one end of the machine, the charging and discharging mechanism being motorised for remote control. The highly efficient action of the unit is obtained by both a cascade and lateral movement of the material, the lateral distribution being obtained by pivoted chute plates fitted with differential linkages.



Large powder blending machine for "Acrilan" factory in W. Ireland

New Companies

Irvine Thread Company Ltd. Private. Reg. March 11. Capital £3,000 in £1 shares. Spinners, doublers and weavers of cotton, silk, wool and jute, etc. The first directors are:—W. H. Mossman, J. H. Smith and D. McBride, all of 5 St. Vincent Place, Glasgow, C.1.

Celanese Corporation of America. Filed March 14, 1958. Capital stock: 11,148,179 shares and 1,000,000 preferred stock of 100 Dollars, 148,179 7% 2nd preferred stock of 100 Dollars and 10,000,000 common stock without par value. Manufacturers and dealers in cellulose and any other manufactured product, etc. British address: 22 Hanover Square, W.1.

Industry Fabrics Company Ltd. Private. Reg. March 20. Capital £20,000 in £1 shares. Cotton cloth manufacturers, spinners and doublers, etc. Registered Office: Premier Mill, Darwen, Lancs.

Kindaire Ltd. Private. Reg. March 21. Capital £1,000 in £1 shares. Merchants, manufacturers, importers and exporters. Registered office: Lloyds Bank Chambers, Saltaire, Shipley.

Pinehurst Textiles Ltd. Private. Reg. March 21. Capital £10,000 in £1 shares. Knitters, weavers, spinners, manufacturers and dealers in nylon, rayon, etc. Solicitors: Victor Mishcon & Co., Norwich House, Southampton Place, W.C.1.

S. and V. (Overseas) Textiles Ltd. Private. Reg. March 24. Capital £1,000 in £1 shares. Registered office: 36 Spring Gardens, Manchester 2.

Lois Fabric Printing Company Ltd. Private. Reg. March 24. Capital £2,000 in £1 shares. Fabric printer. Registered office: 129 Radcliffe Road, Bolton.

Ebakebor Ltd. Private. Reg. March 25. Capital £5,000 in £1 shares. Manufacturers, dealers, factors and agents in wool, flax, etc. Registered office: 5 Great Winchester Street, E.C.2.

Readman and Rees Ltd. Private. Reg. March 26. Capital £2,000 in £1 shares. Bobbin manufacturers, etc. Registered office: Leyland Works, Leyland Lane, Keighley.

Spodden Manufacturing Company Ltd. Private. Reg. March 26. Capital £20,000 in £5 shares. Cotton waste spinners and manufacturers, etc. Registered office: Spodden Mill, Facit, nr. Rochdale.

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RECENT TEXTILE PATENTS

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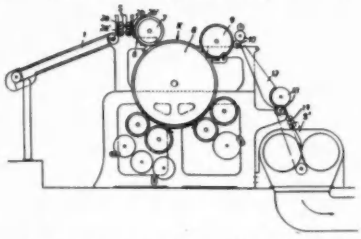
782,612 Processing Synthetic, etc. Fibres

SPINNBAU G.m.b.H., 201 *Farger Strasse, Bremen-Farge, Germany.*

Apparatus for processing synthetic and artificial fibres, as well as waste. The fibre stock passes over a feed table 1 into a stretching apparatus S and is stretched to such an extent that the long chain molecules are brought closer together. The stretching apparatus consists of two pairs of rollers, 2*a*, 2*a'*, and 2*b*, 2*b'*. When the stock has passed through the apparatus, it is carried forward by a feed roller 7 revolving in a feed guide 6 and carried to the cylinder 8 of the card K. The opened and parallelized



stock is removed from the cylinder by a doffer 9, and is conveyed to a pair of delivery rollers 10. As the stock leaves the rollers it passes down the inclined track of a device 12 which compacts the fibres into a band which pass between the feed rollers 13. The condensed band after passing through a drafting device 14 then passes to a staple fibre cutting device S', where it is cut into largely uniform staple lengths. The cut material is taken off in flock form, sucked away and conveyed pneumatically.

782,614 Centrifugal Spinning and Winding Device

C. PUJOL, *No. 3 Calle Corinto, Barcelona, Spain.*

A spinning and winding device for fibres, comprises a rotary centrifugal container which can be reciprocated, a plate with a concave surface which carries the first conical layers of the wound material, which plate is slidably mounted inside the container and is resiliently mounted relative to the bottom. A guide part for the fibres has a central guide channel having in its bottom a concave lower end opposite which is centred a convex surface which constitutes the top end of a central supporting stem for the bobbin on which the winding is effected. The central stem connects with the guide part, so that the gap between the respective concave and convex surfaces, forming a guide channel is kept constant.

782,757 Improved Hand Loom

U. F. T. NORRIS, *Humberstone House, 618 Dunstable Road, Luton.*

Apparatus for connecting the heddle frames of a hand-weaving loom to pedals which operate those frames, comprises non-pivoted beams, one per heddle frame, mounted in guides for vertical sliding but prevented from angular movement at right-angles to the heddle-frames by a rack and pinion mechanism at opposite ends of the beams. The pinions at the opposite ends are rigidly connected by shafts extending parallel to the beams, which are adapted for connection to heddle-frames above and to pedals below.

782,856 Yarn Finishing Process

I.C.I. LTD., *London.*

Process for making improved yarns which comprises flattening fibres protruding from a spun yarn of thermoplastic fibres. The fibres are heated sufficiently to set the thermoplastic fibres in the flattened position, by passing the yarns continuously through a device which contains a heated narrow passage which flattens the protruding fibres against the yarn. The effective diameter of the passage is not greater than twice the diameter of the yarn and its length at least one half the average length of the fibres protruding from the main body of the yarn.

783,126 Anti-Felting Treatment for Wool

WOLSEY LTD., 31 *King Street, Leicester.*

Process for reducing the tendency of materials consisting wholly or partly of wool to felt-shrink, in which the material is treated in a solution having a *p*H between 1 and 2 to which a chlorinating or brominating agent is added as a drip feed. The drip feed is such that the agent is added at such a rate that the time of addition for each 1% of chlorine or bromine (calculated on the weight of the material) is at least five minutes and is preferably about ten minutes. In one example, 50 lbs. of all wool half-hose were stirred in 150 gallons of 0·05N sulphuric acid while 1 lb. of chlorine as sodium hypochlorite was added over a period of 20 mins., by a drip feeding device. After neutralising with sodium carbonate and simultaneously adding sodium bisulphite as an anti-chlor, the wool was rinsed with water to remove excess acid. The half-hose on washing showed a length shrinkage of 5·0% compared with 24·0% for a similar untreated half-hose.

783,134 Device for Colouring Warp Threads

P. STEVENS, *Harlebeke (Belgium), 169 chaussée de Courtrai.*

A device for colouring warp threads comprises dyeing tanks, the number of which varies according to the colours required and to the arrangement used, the tanks being used entirely or partially according to the variety of the patterns to be obtained. Keys arranged above the dyeing tanks are adapted to lower, as required, the threads running above the tanks, so that they come into contact with the dye in the tanks. A control mechanism is provided for the keys and the threads pass through a drying device in order to remove the excess moisture before the weaving proper, and for fixing the dye.

783,287 Treating Fabrics and Fibres with Corrosive Gases

J. DUNGLER, 5 *Langegasse, Basle, Switzerland.*

A process for the treatment of fabrics, fibres, etc., continuously passed through a heating chamber supplied with a superheated vapour with corrosive gases produced by the decomposition of reagents, with which the material undergoing treatment has been previously impregnated, due to the heating effected by the superheated vapour. The quantity of heat transmitted to the continuously moving material is such that the impregnating liquid is wholly converted into a superheated vapour to prevent corrosion of the heating chamber and its adjuncts, the heating chamber being provided with means for exhausting excess vapour.

783,352 Improved Electric Switch-Gear

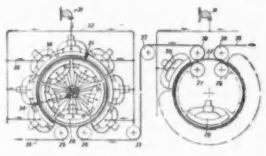
T.M.M. (RESEARCH) LTD., *Hartford Works, Oldham.*

An electrically-driven machine having a number of alternative control stations, and comprising a driving motor, a clutch arranged (when engaged) to transmit motion from the motor to moving parts of the machine, and circuits connecting the control stations to electro-magnetic mechanism for operating the clutch in such manner that the operations of starting, stopping or "inching" the machine may be performed by the actuation of a single push-button at any control station.

783,442 Heating of Drying Drums

W. W. SPOONER, *"Ashbrook," Grove Road, Ilkley, Yorkshire.*

Describes a drum for the temperature treatment of materials. The drum 21 is supported on rollers 25 and 26, and a drum 22 on rollers 27 and 28. Heating units 29 having a convex arcuate surface provided with nozzles are disposed around the available inner surface of the drums, and similar units 30 having a concave arcuate



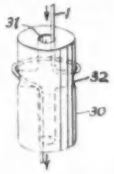
surface are disposed around the available outer surface. Heating air is circulated through heaters and after projection from the nozzles onto the surface of the drum is collected and recirculated. To compensate

for the wastage of air, make-up air is supplied to all the heating units of one drum by a fan 31. This fan feeds a common header 32 from which supply lines 33 distribute the make-up air to the outer heating units. A hollow shaft 34 within each drum is utilised as a header for supplying make-up air to the inner heating units of that drum. A strip of material 36 to be dried is led onto drum 21 around the roller 25 and is led off around roller 26. The web is transferred over guide rollers 37 to a lead-on roll 38 of drum 22 and leaves this drum around lead-off roll 39.

783,493 Twisting Tube for Crimping Filaments

L. Ubberlohde, 100 *Lindemann Strasse, Dusseldorf, Germany.*

Relates to twisting tubes suitable in false-twisting devices for producing crimp-effects in continuous filaments. The twisting tube 30, which may be made of metal, plastics, or glass, has an axial bore 31 and a transverse bore 32 intersecting the



axial bore. The filamentary bundle 1 is fed at one end of the tube into the axial bore, passes out through the transverse bore, is wound one half turn around the tube, enters again through the other end of the transverse bore, and is finally drawn off from the tube, through the other end of the axial bore.

783,698 Shuttleless Looms

M. Claeys, 86 *Cours Vitton, Lyon, France.*

A weft inserter for shuttleless looms comprises an elongated body, the end portions of which are of ogival cross-section and which includes two members which co-operate to form a slot which is adapted to receive, during the beat-up movement of the slay, a length of weft which is disposed in the path through which the inserter moves. At least one of the members is shaped to provide means for retaining the weft in the slot during the return movement of the slay.

783,806 Anti-Static Process

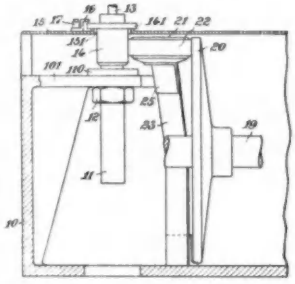
Boehme Fettchemie, G.m.b.H., 67 *Henkelstrasse, Duesseldorf, Germany.*

A process for the prevention of electrical charging of fibres, etc. This charging and the disadvantages which accompany it, can be eliminated if the materials are treated with such fatty acids or fatty alcohols as contain in the molecule at least two double bonds and more than 10 carbon atoms. Their derivatives such as esters, ester salts, ethers, amides and salts are also suitable in the same way. In one example, a mixture is prepared from 80 parts by weight of linoleyl alcohol and 20 parts of Turkey red oil, and 1-20 g. of this mixture are emulsified in 1 litre of water. A Perlon fabric is treated with this emulsion, centrifuged until its liquid content is 30% by weight of the fabric, and dried. After this treatment the fabric no longer shows any antistatic charging.

783,935 Spindle Driving Mechanism for Spinning and Twisting Frames

Skf Kugellagerfabriken Gesellschaft Mit Beschrankter Haftung, 13 *Ernst Sachs Strasse, Schweinfurt am Main, Germany.*

Improved spindle driving mechanism for spinning and twisting frames. In a casing 10 a spindle bolster 11 is mounted on a shelf 101 by a flange 110 and a nut 12. In the bolster there is received a spindle bearing which carries a blade on the part 13 of which a bobbin is to be mounted. The spindle is driven through its wharve 14 which is mounted fast on the spindle blade. At the top of the wharve there is a flange 141 overlying an aperture 151 in a cover plate 15. In order to prevent the spindle blade from being pulled out during doffing of the bobbin, there is provided on the cover plate a hook 16 which reaches over the flange. To permit the spindle blade to be dismounted when necessary, the hook 16 is held in place by a rubber sleeve 17 which permits the hook to tilt. The spindle is driven from a driving shaft 19 driven by a motor. On the driving shaft there is mounted a friction wheel 20 and between wheel 20 and spindle wharve 14 there is provided an intermediate wheel 21 which has a coating 22

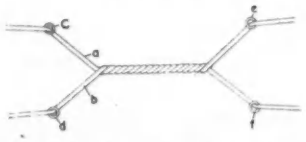


having a high coefficient of friction. The intermediate wheel is located on a plate spring 23 and is parallel to the axis of the spindle. The plate spring is arranged beside the driving shaft 19, and due either to its formation or to its position, the plate spring presses the intermediate wheel in a direction perpendicular to the line connecting the points of contact between the intermediate wheel and the spindle wharve, and between the intermediate wheel and the driving wheel.

784,004 Synthetic Yarn Crimping

Fine Spinners and Doublers Ltd., *Manchester.*

An improved method of crimping yarns of man-made thermoplastic fibres or filaments in which the whole process from winding-off the supply package to winding-on to the take-up package can be carried



out as a continuous operation. In one arrangement two yarns *a* and *b* are led to a heating zone through the guides *c* and *d* are then twisted together and each is delivered through a separate guide *e* or *f*. The two yarns are twisted together before being threaded through the guides *e* or *f*, but after they have been threaded through the guides and connected each to a take-up package, the yarns will continue to twist together and untwist as they travel between the guides.

784,026 Variable-Position Drafting Roller

W. Astbury, 112 *Fitzroy Road, Bradford.*

A drafting roller assembly for a gill-box comprises a variable-position press roller within movable slotted arms and long bosses at each side which are held to frames by circular clamps which allow the press draft roller to be set in any required position. G1 is a steel boss to which the steel arm G2 is welded. Within the boss is a self oiling bronze bearing G3, and surrounding the boss is the circular clamp G4 with bottom lug G5 welded to it. The bottom draft roller D2 revolves within bearings G3, and top draft roller D1 revolves within a square block G6 and its bronze bearing G7. Between the draft rollers is the endless leather apron E2. The whole assembly is bolted in position to the machine frame F1 whilst the slot F2 allows the position of roller D2 with the leather apron around it to be set, by means of an adjusting screw F3, to the circle E3 representing pin points on rotor A. The arc F4 represents movement of arm G2 which is obtained by loosening of the bolts and moving arm G2 by hand to any required gap between roller D1 and the circle of pin points E3 of the rotor.

784,031 Gill Box Drafting Rollers

O. Steinawndt, *Waldshut-Baden, Germany.*

Device for automatically clearing the drafting rollers of a gill box which will not require any special separate driving mechanism. The device comprises a clearing cloth or roller and a member which co-operates with the gill bars of the gill box during the transfer from the lead screw to the return screw of the gill box to impart a driving movement to the clearing cloth or roller.

784,171 Flame—and Water-proofing Materials

K. Quehl, *Burgstrasse 6, Speyer/Rhine, Germany.*

A process for the simultaneous flame-proofing and water-repellent finishing of materials, comprises impregnating the materials with an acid bath obtained by mixing a solution or dispersion of substances having a water-repellent action and of chlorinated organic compounds having a fixative action, with an organic acid and stabilizers and with solution of an aluminium or zirconium salt, and incorporating one or more metal oxides producing protection against flame. In one example, 0·5 to 1·5 parts of gum arabic and 1·5 to 3 parts of blood albumin were dissolved in five times the amount of water, and there was slowly added 0·5 part of formic acid and then 3 to 5 parts of aluminium formate (11° Be) and finally 15 to 20 parts of water. At the same time, a second solution of 4 to 6 parts of post-chlorinated polyvinyl chloride, 0·5 part of pentachlorophenol and 2 to 3 parts of paraffin was dissolved in a mixture of 8 to 12 parts of acetone and 22 to 18 parts of trichloroethylene. This solution was added to the first solution while stirring well, and 12 to 15 parts of antimony trioxide, 1 to 3 parts of zinc borate, which was suspended in double the amount of water.

and 8 to 12 parts of an olive-green pigment dyestuff were slowly added. After the mixture has been homogenised, it was padded onto dyed net, and the pressure adjusted so that the net absorbed approximately 100% of its weight. After drying there was obtained a weather-resistant flame-proofing and a very good rot-proof effect in addition to a very good water-repellent effect.

784,236 Measurement of Yarn

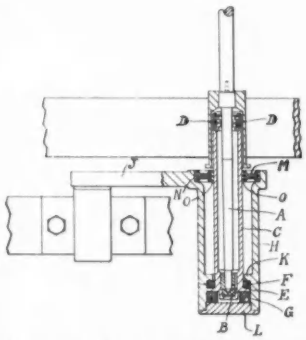
BRITISH RAYON RESEARCH ASSOCIATION, *Manchester*, and DUKES AND BRIGGS ENGINEERING COMPANY LIMITED, 80 *Ashley Road, Hale, Chester.*

Describes a convenient portable and relatively inexpensive means for the measurement of yarn speed. The instrument comprises a source of light capable of being flashed at any of the wide range of known frequencies, and apertured means adapted for rotation by the yarn before the source. The aperture is so disposed, that the light from the source when energised passes through to provide a visual indication by virtue of which, at a given frequency of flashing, the speed of travel of the yarn may be ascertained. By means of this instrument yarn speeds which are constant over a given time can be calculated by adjusting the flashing frequency of the light source until the position of the aperture when lit is always the same.

784,242 Spindle Mounting for Winding and Twisting Machines

S. AND E. SCRAGG LTD., and F. SCRAGG, *Oxford Road Works, Macclesfield.*

An improvement in the method of mounting the spindles of winding and twisting machines. The end of the spindle blade A is in a bearing B in the lower end of a sleeve C and is held by a roller or needle bearing D at the upper end of the sleeve C. A flange E on the exterior of the sleeve is clamped between two resilient washers F, G at the bottom of a cup H on the end of a pivoted arm J. The washer F engages with the underside of a flange K on the inside of the cup and is held in engagement by a member L which engages with washer G and screws into the lower end of the cup. The movement of the sleeve due to an out of balance package on the spindle is damped by a member between the sleeve and the upper end of the cup. The damping member comprises a diaphragm M of oil resisting rubber is provided with outer and inner metal rings



N, O to which the rubber is secured. The ring N is secured to the cup and ring O grips the sleeve C. By moving ring O along the sleeve C, tension will be applied to the diaphragm and its damping action increased.

784,437 Bleaching Non-Woollen Materials

STEVENSONS (DYERS) LTD., *Amber Dye Works, Ambergate, Derbyshire.*

A process for bleaching materials not containing wool, wherein the materials are treated in an aqueous medium with permonosulphuric acid or salt at a temperature of above 80° C. and up to the boiling point of the medium. In one example, scoured Orlon yarn was entered into a bath containing 0·5 gm. per litre of permonosulphuric acid at 80° C. and at pH 2·3. This was then brought to 100°C. in 5 minutes and boiling continued for a further 35 minutes. The yarn was then rinsed and dried. In another example, scoured Terylene yarn was treated in a bath containing 3 parts of permonosulphuric acid in 1,000 parts of water at *p*H 1·1 for 1 hour at the boil. The yarn was then rinsed and dried.

784,532 Cleanliness on Winding Machines

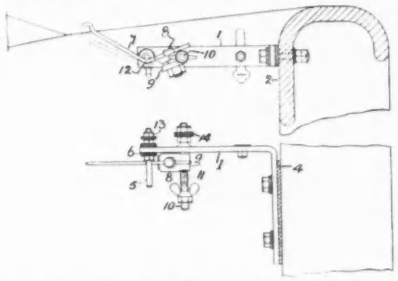
D. FRASER AND SONS LTD., *Westburn Foundry, Arbroath, Angus, Scotland.*

An arrangement to provide for cleanliness and an enhanced appearance of a winding machine, and to provide for protection in a simple manner of the controlling mechanisms for the cradles. In such a winding machine, the controlling mechanisms for the cradles are arranged in groups of at least two mechanisms, each of which is covered by a shroud common to that group.

784,654 Apparatus for Detecting Gaws

SCOTT AND FYFE LTD., *Scotscraig Linen Works, Tayport, Fife, Scotland.*

An apparatus for detecting gaws, i.e. missed weft threads, in cloth while being woven. 1 denotes a plate attachable to the breast rail 2 insulated by insulation 4 from the plate 1. 5 denotes a fixed electrical contact pin carried by the plate and insulated from the plate by washers 6. 7 denotes a feeler penetrating the head of a clamping screw 8 supported by a bracket 9 mounted on a pivot pin 10 fixed to the plate. The bracket 9 is urged by a spring 11 to swing towards the position in which



the feeler is against the pin 5, the portion 12 of the feeler constituting a second contact. 13 and 14 denote terminals connectible to means for stopping the loom. The terminals 13 and 14 are connected in the circuit of a relay adapted to control the stop mechanism of the loom. When cloth is being woven the feeler presses against one of the surfaces of the cloth and is held, in opposition to the spring 11, in the position in which the contacts 12 and 5 are open. If a gaw should form in the cloth, the feeler is moved by the spring through the gap left by the missing weft, the contacts 12 and 15 close and the stop mechanism is operated.

785,929 Tentering and Drying Machines

FAMATEX G.M.B.H., *Kornwestheim, Stuttgart, Germany.*

Tentering and drying machines having nozzles for blowing heated air, on to a fabric, the nozzles being connected with fans which suck the hot air through filters and heaters before blowing it on to the web. The filters of the machines are provided with cleaning means for removing impurities, such as dust fibres, etc., retained by the filters.

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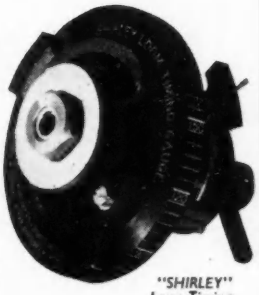

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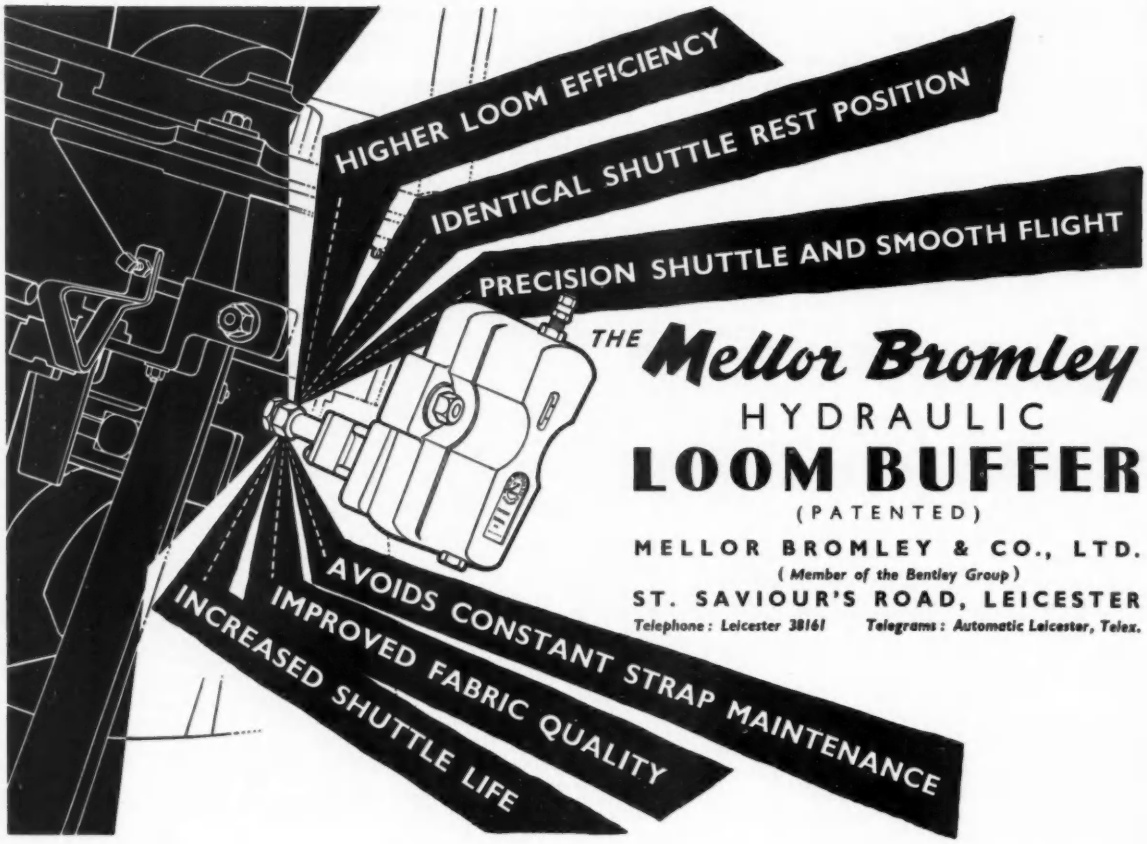

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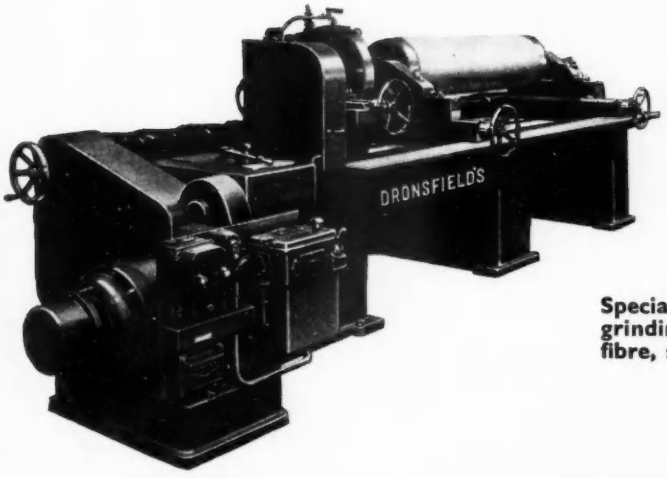

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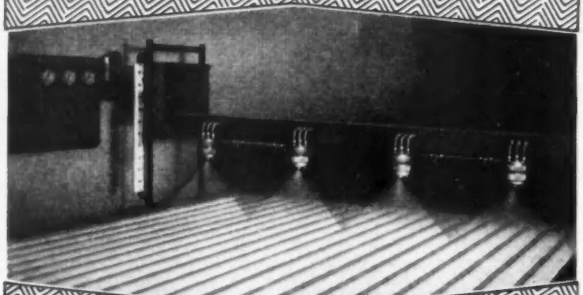

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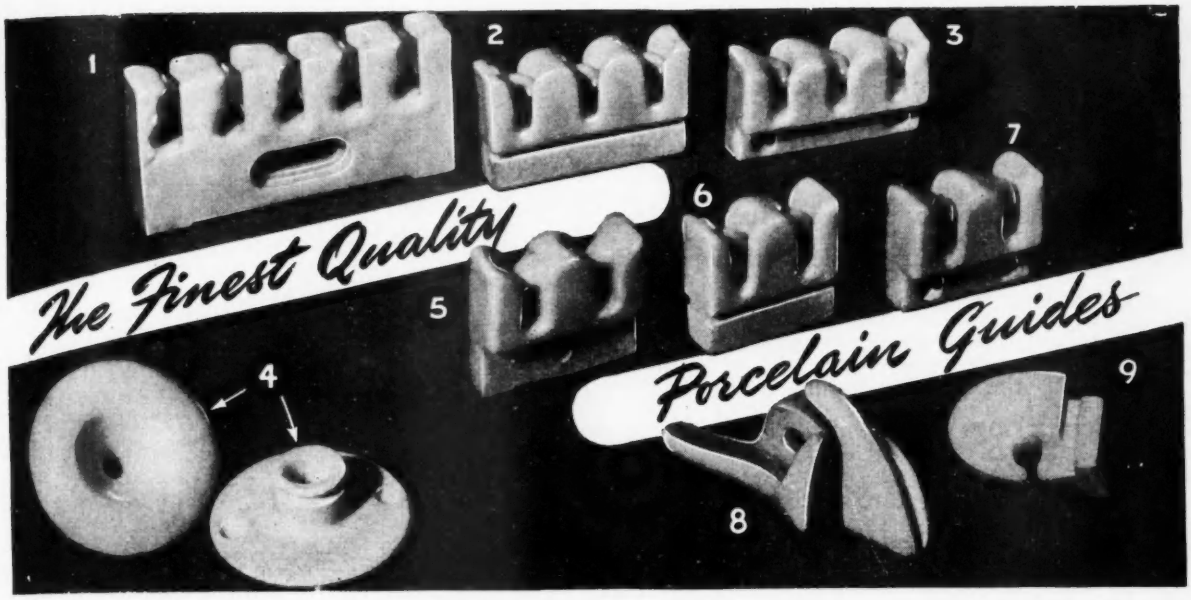

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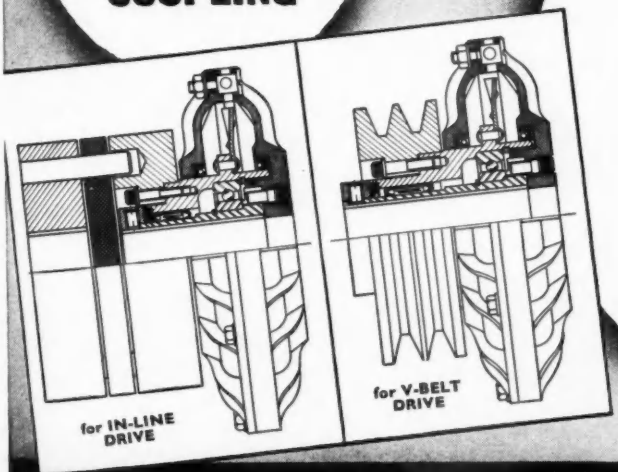

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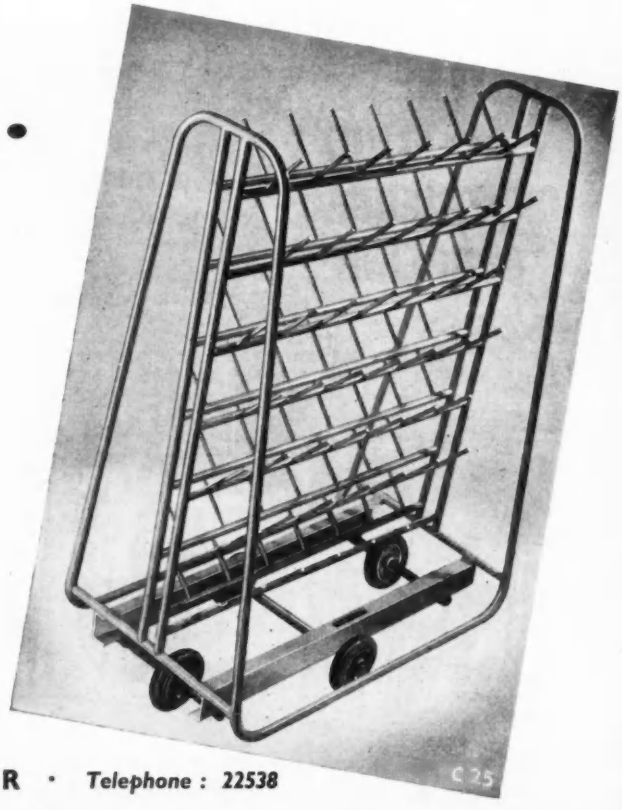

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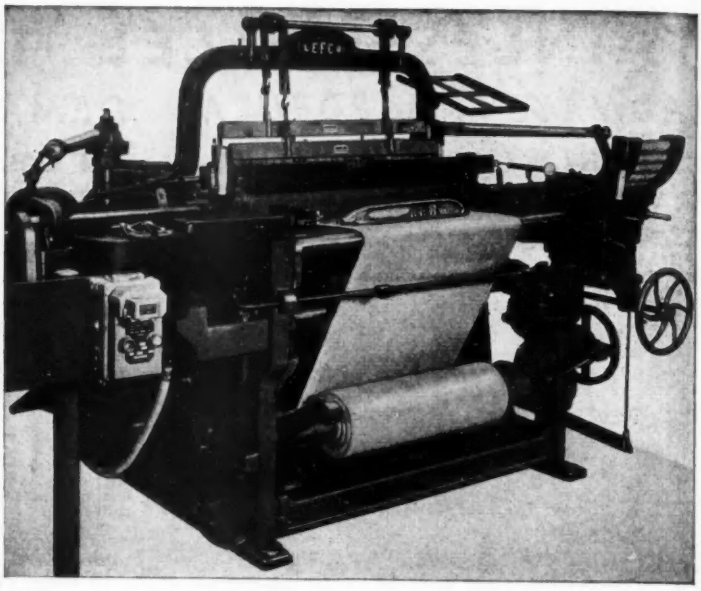

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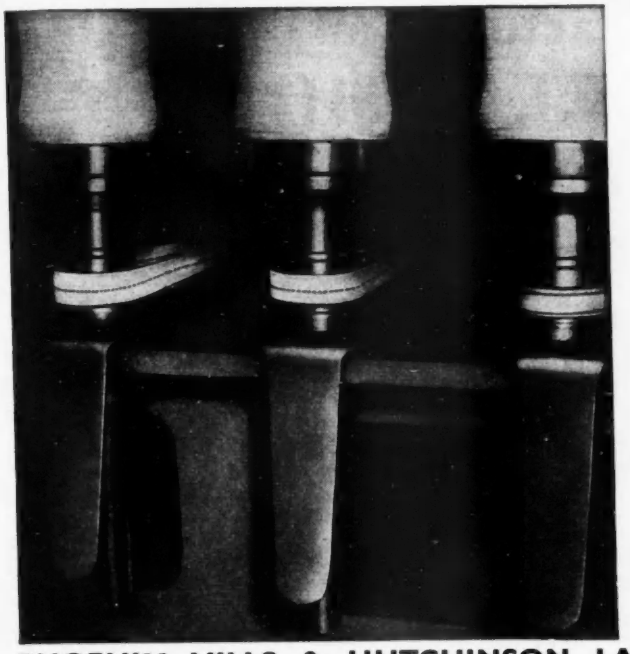

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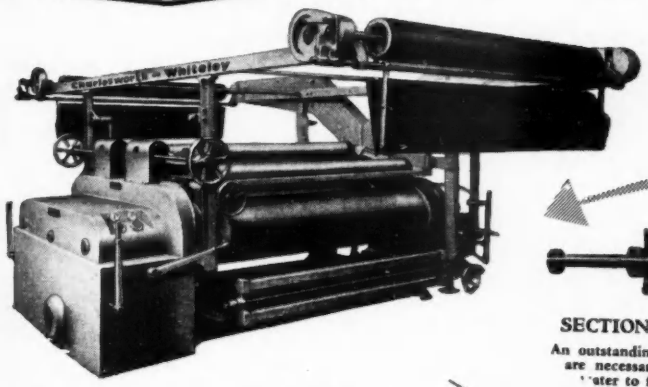

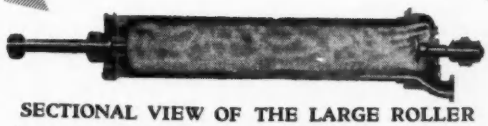

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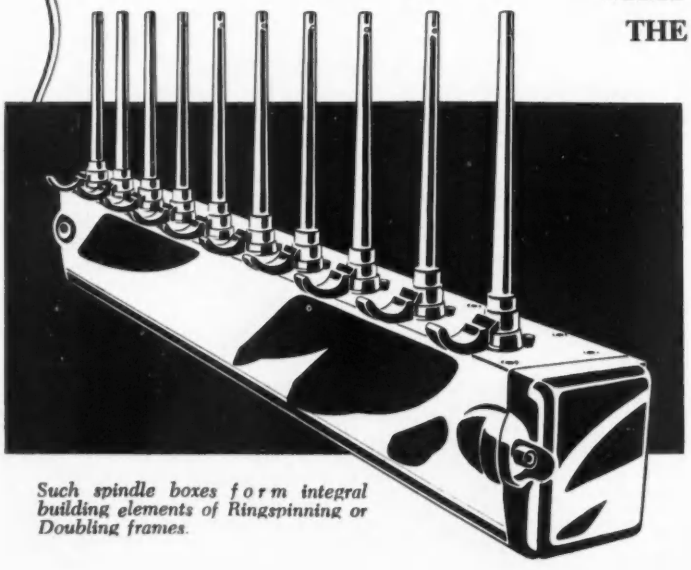

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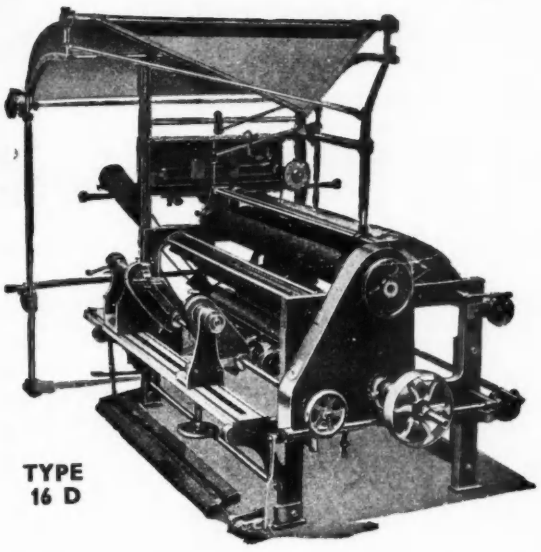

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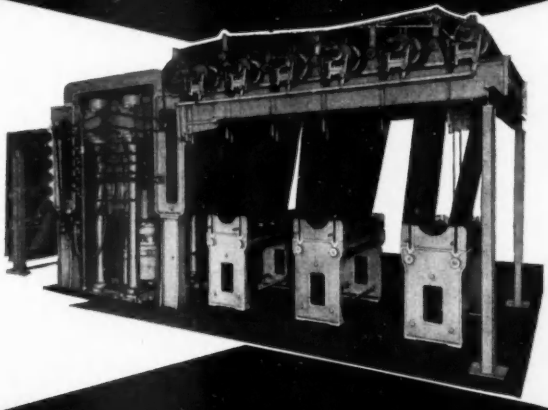

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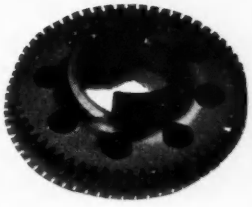

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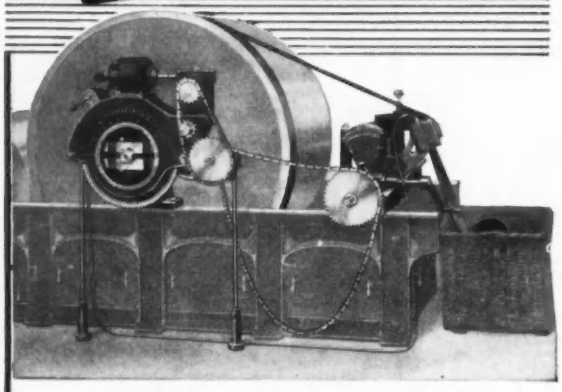

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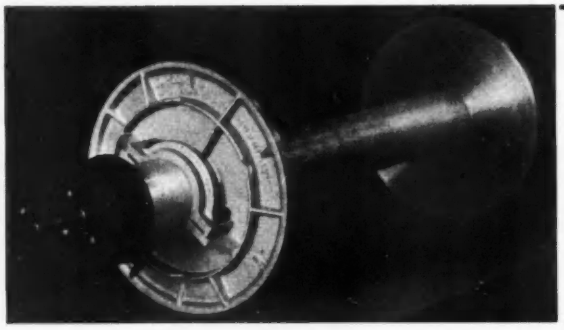

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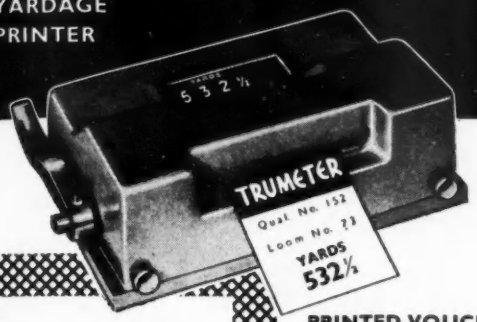

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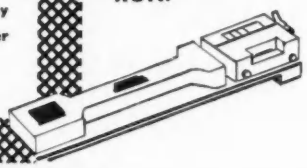

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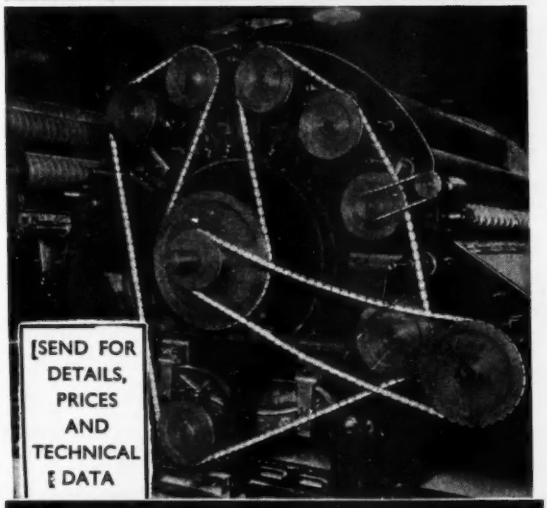

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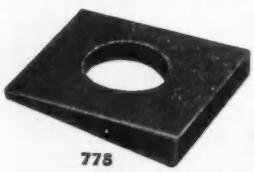

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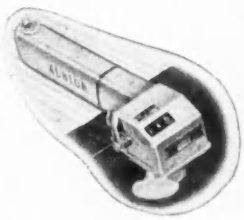

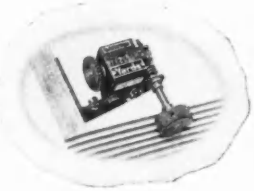

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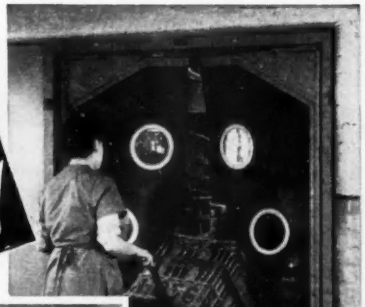

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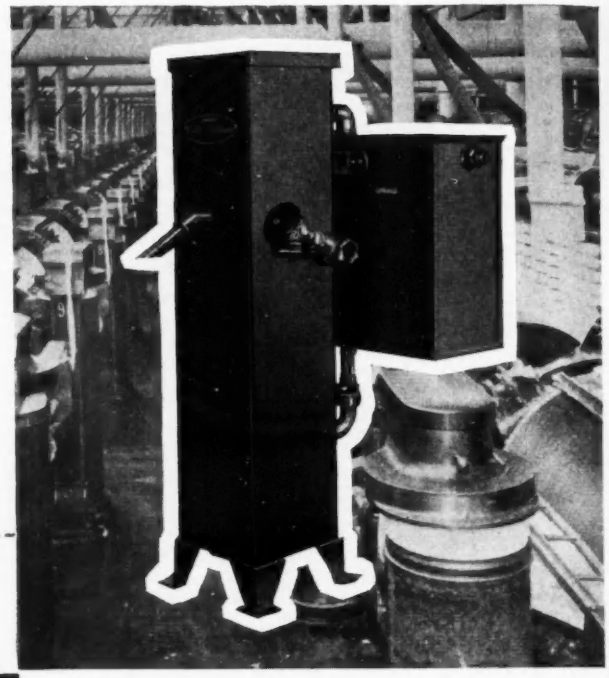

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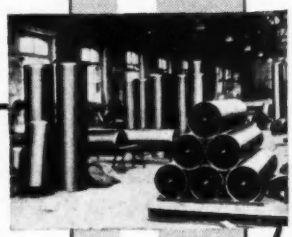

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RP 9

Index to Advertisers

Italic Figures denote advertisements on literary pages

Adolff, Emil
Aluminium Bronze Co. Ltd. 85
Anchor Chain Co. Ltd. 41
Andre Rubber Co. Ltd. 9
Angus, George & Co. Ltd.
Appleby, Joseph, Ltd.
Arkwright, Sir R. & Sons Ltd.
Armstrong Cork Co. Ltd.
Arrow Electric Switches Ltd.
Arundel, Coulthard & Co. Ltd. 14
Ashworth, Arthur Ltd. 1
Aspinall, A. E. Ltd.
Associate Rediffusion Ltd.
Audley Spinning and Manufacturing Co. Ltd.

Balmes (England) Ltd.
Basford, Dyers Ltd.
Bayard Publicity Ltd.
Benninger Engineering Co. Ltd.
Bennis Combustion Ltd. 51
Benton & Stone Ltd.
B.E.N. Patents Ltd. 19
Birfield Industries Ltd. 35
Birkett, Billington & Newton Ltd.
Birmingham & Blackburn Construction Co. Ltd. 97
Birmingham Battery & Metal Co. Ltd.
Blackburn, Thos. (Brighouse) Ltd. 87
Blakelys Textiles Ltd.
Bleachers' Association Ltd. 60
Blomfield, Maurice Ltd.
Bodden, Wm. & Sons Ltd.
Boettcher, H.
Boucher & Co. Ltd. 39
Bound Brook Bearings (G.B.) Ltd.
Boyd, J. & T. Ltd.
Bradford Dyers Association Ltd.
Brammer, H. & Co. Ltd.
Breaks Brothers Ltd. 95
Bright, John & Bros. Ltd. 86
British Celanese Ltd.
British Electrical Development Association
British Geon Ltd.
British Insulated Callender's Cables Ltd. 69
British MonoRail Ltd.
British Northrop Ltd. 36
British Nylon Spinners Ltd.
British Overseas Airway Corporation 64a
British Picker & Co. Ltd.
British Railways 93
British Road Services
British Rolling Mills Ltd. 20
British Stationery Council 71
British Thomson-Houston Co. Ltd.
Broadbent, Thos. & Sons Ltd. 84
Brown, N. C. Ltd. 96

Cambridge Instruments Ltd.
Carter, H. R. & Son Ltd.
Carter, B. & F. & Co. Ltd. 96
Carter Gears Ltd. 5
Casablancas High Draft Co. Ltd. 11
Churchfields Spring Co. Ltd.
Cinema-Television Ltd.
Clancey, G. Ltd. 95
Clifford, Charles Ltd.
Colodense Ltd. 16
Combined English Mills Ltd.
Courtaulds Ltd.
Crabtree Bros. (Waterside) Ltd. 58
Crabtree, David & Sons Ltd.
Cradley Boiler Co. Ltd.
Craig, A. F. & Co. Ltd. 52
Crepe Sizes Ltd.
Crofts (Engineers) Ltd.
Crompton Parkinson Ltd.
Crowther Ltd.
Cuxson, Gerrard & Co. Ltd. 92

Dalglish, John & Sons Ltd.
Danks, Edwin & Co. (Oldbury) Ltd. 28
Davidson & Co. Ltd.
Darwin & Sons
Davidson, MacGregor & Co. Ltd. 85
Dayton Rubber Co. Ltd. 15
Devoge & Co. Ltd.
Dick, R. & J. Ltd.
Dixon, John & Sons Ltd. 90
Dodd, S. & Sons Ltd. Inside Back Cover
Dracup, Samuel & Sons Ltd. 72
Drayton Regulator & Instrument Co. Ltd.
Dronsfield Bros. Ltd. 81, 92
Dunlop Rubber Co. Ltd. 47
Durrant, George & Sons Ltd.

Eadie Bros. & Co. Ltd.
Ekco-Ensign Electric Ltd.
Electric Construction Co. Ltd. Inside Front Cover
Ellison, George Ltd.
Eloflock, G.m.b.H.
Emmott & Co. Ltd. 46, 48, 56, 79
Emmott, G. (Pawsons) Ltd.
Engel & Gibbs Ltd.
English Electric Co. Ltd. 50
English Numbering Machines Ltd. 92
Erskine Heap & Co. Ltd. 7
Erhardt & Leimer Ltd.
Evans, F. W. Ltd. 79
Evertaut Ltd.

Fairitt Eng. Co. Ltd.
Farmer, Norton, Sir James & Co. Ltd.
Fawcett, Preston & Co. Ltd.
Fearnehough, W. Ltd.
Ferguson Pailin Ltd.
Fine Spinners & Doublers Ltd.
Firth, Richard & Sons Ltd.
Firth Vickers Stainless Steels Ltd.
Fischer Bearings Co. Ltd.
Fischer, George Ltd. 45
Fletcher Miller Ltd. 31
Flexibox Ltd. 76
Formica Ltd.
Foxboro-Yoxall Ltd. 12
Foxwell, Daniel & Son Ltd.
Frankfurt Trade Fair
Fraser, Douglas & Sons Ltd.
Frost, Wm. & Sons Ltd. 92

Gas Council, The Outside Back Cover
General Electric Co. Ltd. 3
Gilbos, Sprl.
Gill, Thomas & Sons Ltd. 97
Glacier Metal Co. Ltd.
Goodyear Tyre and Rubber Co. (G.B.) Ltd. 63, 73
Granwood Flooring Co. Ltd.
Green, E. & Son Ltd.
Greenwoods Standard Gearcutting Co. Ltd. 79
Grob & Co. Ltd.
Guest, Keen & Nettlefolds Ltd.
Gusken, Jean, G.m.b.H.
G. W. B. Furnaces Ltd.

Haigh John & Sons Ltd. 58
Hagues Textiles Ltd. 81
Halifax Tool Co. Ltd. 93
Hall & Kay Ltd.
Hampson, Wm. (Oldham) Ltd.
Handy Angle Ltd.
Hanover Trade Fair
Hardaker, J. T. Ltd.
Hardings (Leeds) Ltd.
Hattersley, George & Sons Ltd. 57
Hattersley Pickard & Co. Ltd. 89
Headland Engineering Developments Ltd.
Heath, G. H. & Co. Ltd.
Heywood Textile Accessories Ltd.
Heywood, W. H. & Co. Ltd.
Hexoran Co. Ltd. 93
Hibbert, Joseph & Co. Ltd.
Higgs Motors Ltd.
High Duty Alloys Ltd.
Hindle, Son & Co. Ltd.
Hodgkinson, James (Salford) Ltd.
Hoffmann Manufacturing Co. Ltd. 25
Holdsworth & Gibb Ltd. 48
Holmes, W. C. & Co. Ltd.
Holdsworth, James & Sons (Halifax) Ltd. 97
Holt, Thomas Ltd. 21
Hordern-Richmond Ltd.
Howorth, James & Co. Ltd.
Hudson, Irvin Ltd.
Hughes & Lancaster Ltd.
Hunt & Moscrop Ltd.

Imperial Chemical Industries Ltd. 65
India Mills (Darwen) Ltd.
Industrial Drives Ltd.
Industrial Fan & Heater Co. Ltd.
Intermit Ltd. 35
Ioco Ltd.

Johnson & Hartley Ltd. 82

Kaye, E. & E. Ltd.
Keay, Thomas C. Ltd. 86
Keith Blackman Ltd.
Kelvin & Hughes Ltd.
Kilbourn Martin Ltd. 84
Kings Patent Agency Ltd.
Kleinwefers, Joh.
Knowles, Frank & Co. Ltd.
Knowles Peers Ltd. 96
Kovo Ltd.

Lancashire Cotton Corpn. Ltd.
Lancashire Dynamo & Crypto Ltd.
Lang Bridge Ltd.
Laporte Chemicals Ltd.
Lawson, R. P. & Sons Ltd.
Ledray, Samuel & Sons Ltd.
Lenson Engineering Co.
Lep Transport Ltd.
Light Alloy Construction Ltd.
Lindsay, Henry Ltd. 94, 96, 100
Linz, L. & Sons Ltd.
Livesey & Aspinall Ltd. 30
Lock, A. M. & Co. Ltd. 97
Lodge Plugs Ltd.
Longclose Engineering Co. Ltd. 13
Lupton Bros. Ltd.
Lupton & Place Ltd. 94

Macart Textile (Bradford) Ltd.
Mackie, James & Sons Ltd. 70
Magnesium Elektron Ltd. 23
Manchester Metal Works Ltd.
Manchester Oil Refinery (Sales) Ltd.
Mandleberg, J. & Co. Ltd.
Manganese Bronze & Brass Co. Ltd. 8
Manlove, Alliott & Co. Ltd.
Mather & Platt Ltd.
Maynard, R. S.
May & Baker Ltd.
Mellor, Bromley & Co. Ltd 24, 80
Metcalf, George & Co. Ltd.
Metropolitan Vickers Electrical Co. Ltd. 77
Meynell & Son Ltd.
Midland Bank Ltd. 90
Mills, Wm. Ltd.
Monsanto Chemicals Ltd. 68
Moore & Avery Ltd.
Morris, Herbert Ltd.
Mountford, Frederick (Birmingham) Ltd.
Muller, Franz
Mutual Mills Ltd.

National Industrial Fuel Efficiency Service
Negretti & Zambra Ltd. 53
Norman Evans & Rais Ltd. 32
Northern Mill Supply Co., The 83, 94
Northern Photo Engraving Co. Ltd.
North Western Electricity Board
Nu-Swift Ltd. 75

(*continued on page* 100)

Index to Advertisers

(*continued from page* 99)

O'Brien, J. Owden & Son Ltd. 79
O'Neill, Samuel & Sons Ltd.
Obermaier & Co. 32
Ogden, M. & Co. Ltd.
Oppenheimer Casings Ltd.
Orme, George & Co.

Padley & Venables Ltd.
P.A.M. Ltd.
Pegg, Samuel & Son Ltd. 18
Permoglaze Ltd.
Perry Chain Company Ltd.
Petrie & McNaught Ltd.
Petrofina (G.B.) Ltd. 38
Phillips, B. L. & N. Ltd. 49
Pilkington Bros. Ltd.
Platt Bros. (Sales) Ltd.
Platt, J. W. & H. Ltd.
Plutte, Koecke & Co. 27
Power Petroleum Co. Ltd. 2
Powder Couplings Ltd. 83
Prince-Smith & Stells Ltd.
Pritchard, Robert & Sons Ltd. 98
Proctor, James Ltd.
Prodorite Ltd. 91

Quick Wrap Tubing Co. Ltd. 64

Ransome & Marles Bearing Co. Ltd.
Ransome, Sims & Jefferies Ltd. 54
Renard, B. & Co.
Renold Chains Ltd. 74
Reynolds, T. I. Aluminium Ltd.
Riley, T. W. Ltd.
Ruti Machinery Works Ltd. 59
Ryder, Thomas & Son Ltd.
Ryder, Wm. Ltd.

Salter, Geo. & Co. Ltd. 42
Sanco Trading Co. Ltd. 79
Sanderson & Co. (Textile Engineers) Ltd.
Scharer Textile Machine Works 37
Schweiter Ltd. 30
Scott, Hugh J. & Co. (Belfast) Ltd...
Scragg, Ernest & Son Ltd.
Sellers & Co. (Huddersfield) Ltd. 62
Sellers, Joseph & Son Ltd. 88
Sheepbridge Alloy Castings Ltd.
Shell Chemical Co. Ltd. 43
Shirley Developments Ltd. 79
Siemens Edison Swan Ltd. 67
Silentbloc Ltd.
Simonett, A. & H. (Engineers) Ltd... 89
Sintered Products Ltd. 91
Skefko Ball Bearing Co. Ltd. 66
Small & Parkes Ltd. 93
Smith, S. & Sons (England) Ltd. 10
Smith, Wm. & Bros. Ltd. 24
Southern & Redfern Ltd. 96
Spencer-Bonecourt-Clarkson Ltd.
Spencer & Halstead Ltd. 6
Square, D. Ltd. 29
Standard Bank of South Africa Ltd.
Standard Chemical Co. 79
Steatite & Porcelain Products Ltd.
Stephens, Ira Ltd.
Stephenson Bros. Ltd.
Sterling Metals Ltd.
Stockport United Chemical Co. Ltd. 94
Stone-Wallwork Ltd.
Stott, James, & Co. Ltd. 98
Stowaca Fibre & Can Co. Ltd. 76
Stubbs, Joseph Ltd.
Sturtevant Engineering Co. Ltd. 55
Suiza, Hispano S.A. 88
Sulzer Brothers Ltd.
Swailes Ltd.

Taylor, F. & Son (M/c) Ltd.
Tatham, Wm. Ltd. 54
Taylor Wordsworth & Co. Ltd.
Tecalemit Ltd. 33
Teleflex Products Ltd. 44
Terry, Herbert & Sons Ltd. 26
Textile Industrial Components Ltd.
Textile Paper Tube Co. Ltd.
Textile Recorder Exhibitions
Textile Machinery (M/c) Ltd. 82
Thames Board Mills Ltd.
Thornton, G. W. & Sons Ltd. 37, 40
Tomlinsons (Rochdale) Ltd.
Tootill & Snape Ltd. 79
Trumeter Co. Ltd. 95
Tufnol Ltd.
Turner Bros. Asbestos Co. Ltd.
Tweedales & Smalley Ltd.

Uhlhorn Bros. Ltd.
Unbrako Socket Screw Co. Ltd.
Universal Winding Co. Ltd. 4
Uttley, F. & Son Ltd.

Vaughan Crane Co. Ltd.
Vulcanised Fibre Ltd. 17

Wadsworth & Co. Ltd. 94
Walker, Crosweller & Co. Ltd.
Walker, P. M. & Co. (Halifax) Ltd. 52
Walker, Thos. & Son Ltd. 34
Wareing Bros. & Co Ltd. 26
Wareing, Thos. & Co. Ltd.
West Yorkshire Foundries Ltd.
Whiteley, B. S. & W. *539*
Whiteley, E. Gordon Ltd. Front Cover
Whiteley, Wm. & Sons Ltd. 87
Whitaker, J. O. (Accrington) Ltd.
Whitin Machine Works
Whittle, T. & Sons Ltd. 95
W.H.K. Products Ltd.
Wigglesworth, Frank & Co. Ltd.
Willmott, Taylor & Co. Ltd. 80
Wilson Bros. Bobbin Co. Ltd.
Wilson & Longbottom Ltd.
Witco Chemical Co. Ltd. 22
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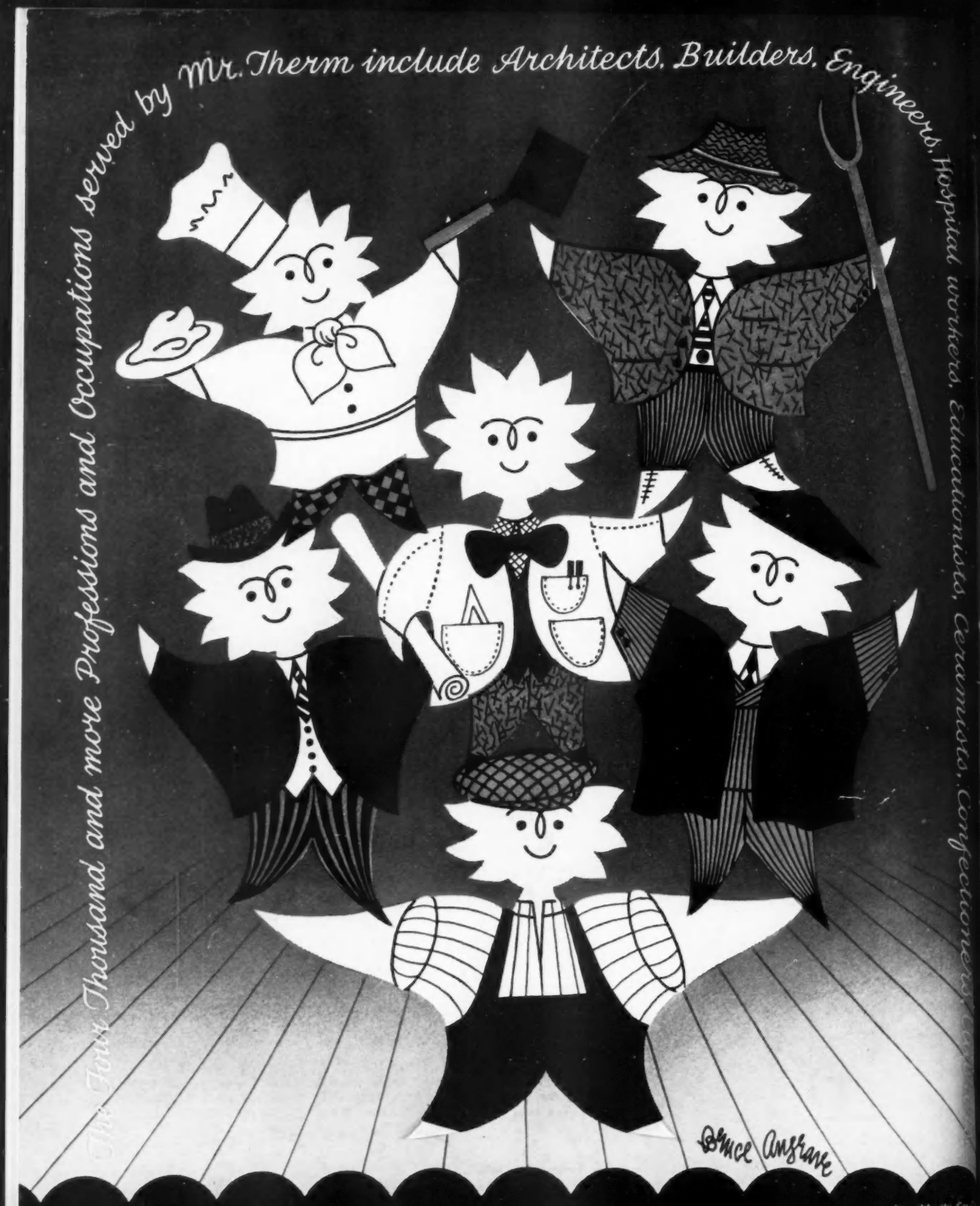
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